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CLASSIFICATION OF THE BEE FAMILY
MELITTIDAE
WITH A REVIEW OF SPECIES OF
MEGANOMIINAE

By
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(The Hesperapis group largely by Gerald I. Stage
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ABSTRACT

This is a revision, to the subgeneric level, of the bee family Melittidae. The family is here divided into three subfamilies, the Meganomiinae, Melittinae, and Dasypodinae, the last being divided into three tribes, the Promelittini, Dasypodini, and Sambini. Several new genera and subgenera are described. Appendices include a revision of the species of Meganomiinae and descriptions of various new species of the other subfamilies.

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INTRODUCTION

As demonstrated previously (Michener and Greenberg, 1980), the Melittidae is a critical family in bee evolution. It not only exhibits many primitive features, but is perhaps the sister group of the Ctenoplectridae plus long-tongued bees. If McGinley (1980) is right that the bifid tongue of colletids is a derived rather than a plesiomorphic wasp-like feature, then the Melittidae could be the ancestral family of bees.

Because it is a rather small family, many elements of which are not well known, and because its classification as proposed by me in 1944 now seems quite inadequate, I here present a new classification. Two recent changes in the content of the family require notice here. First, when melittids were first assembled and separated from other bees, Ctenoplectra was included. The Ctenoplectridae has now been separated and shown to be more similar to the long-tongued bees (Fideliidae, Megachilidae, Anthophoridae, Apidae) than to Melittidae (Michener and Greenberg, 1980). Second, the African genus Meganomia has been removed from the Halictidae and placed in the Melittidae by Stage (1971). He was clearly right in so doing; the matter is of special importance because Meganomia and its relatives (described below) turn out to have a very distinctive combination of plesiomorphic and apomorphic features. They may be the sister group to all the other Melittidae, although the synapomorphic characters of the latter group (all other Melittidae) are few and not very satisfying.

Melittidae mostly have the superficial aspect of andrenid or certain halictid bees. Before the familial attributes of the melittids were known, the melittids with three submarginal cells were often placed near Andrena (e.g., when Friese in 1911 described Rediviva as a subgenus of Andrena). Meganomia, however, was described as a subgenus of Nomia (Halictidae) by Cockerell, 1909, and its species were described in Nomia not only by Cockerell, but also by Friese (1909), Meade-Waldo (1916), and Strand (1920), a generic placement that continued for decades in spite of the lack of nomiine characteristics in Meganomia, until Cockerell (1931a) raised it to generic rank. The yellow and black coloration is more suggestive of an anthidiine bee than of any Nomia or other melittid. Its placement in Nomia can only be attributed to the yellow metasomal bands which, although preapical on each tergum, are suggestive of the apical yellow, green, blue, or white bands of some species of Nomia.

Forms with two submarginal cells were often placed among the panurgine bees (Andrenidae) or dufoureine bees (Halictidae). For example Cockerell described various species of Hesperapis in Panurgus, Friese described the species of Promelitta as a Dufourea, and Morawitz described the species of Eremaphanta in Rhophites (Dufoureinae). Most of the species with two submarginal cells (e.g., Dasypoda, Hesperapis, Capicola) look like Andrena, or the smaller ones like Calliopsis (Panurginae, Andrenidae). Some, for example Haplomelitta, are superficially very like some species of the colletid genus Scapter. Perhaps most noteworthy of all are the tiny species of Eremaphanta which resemble the panurgine genus Perdita or the halictine genera Nomioides and Habralictus in size and coloration.

After studying a number of characters for a selected list of apoid genera, Warncke (1977) placed the genus Pararhophites Friese (= Ctenoapis Cameron) in the Melittidae. The particular characters on which he based this action are not stated. However, there is nothing in Pararhophites morphology specifically to support Warncke's action, and there is much to indicate that it is wrong. The mouthparts are like those of a typical long-tongued bee (Winston, 1979; Michener and Greenberg, 1980). Thus the labial palpus is made up of two long sheath-like basal segments and two small divergent distal segments; the glossa is elongate with a flabellum, a distinct glossal rod, and a narrow salivary channel margined except distally by short hairs, and lacks noticeable branched hairs apically (or elsewhere); the ends of the loral arms are on the cardo-stipital articulation; and the galeal comb is absent (as is the stipital comb). The galeae are elongate (longer than the stipites). Other characters suggesting a relationship to long-tongued bees are the hairs on the propodeal triangle (metapostnotum) and the lack of a distinct oblique brush on the under side of the middle tibia. Attributes of Pararhophites unusual among long-tongued bees are the presence of distinct volsellae (shared with Fideliidae); the short and scarcely curved subligular process; the long ligular arms, extending almost to the base of the prementum (shared with Lithurginae); and the lack of pygidial and basitibial plates (shared with Fideliidae, Megachilidae, Apidae, and others). At this time, however, there is no reason to change Popov's (1949) placement of Pararhophites as a tribe Pararhophitini in the Anthophorinae.

Examination of type material of Andrena melittoides Friese, 1899, the type species of Melittoides Friese, 1921, verified that this is an Andrena, not a melittid.

The present study uncovered several genera and subgenera based on undescribed species. Such species, and a few other taxonomic findings not related to the higher classification of the family, are described in the appendices. The Meganomiinae proved so little known, three of the four genera and four of eight species being new, that its species are revised in Appendix I. The Sambini was even less well known, but since most of its genera and subgenera are monotypic, no treatment is given in Appendix I except for descriptions of new species.

These comments raise the question of the number of genera recognized. Genera of bees are generally large and easily distinguished. In an archaic group such as the Melittidae, however, the existence of various distinctive, small genera is not surprising. There are a few moderately large genera such as Melitta and Dasypoda; Hesperapis, perhaps the largest genus, contains nearly 40 species (Stage, 1966).

AUTHORSHIP

Of course the bulk of the work is by Michener. However, Dr. G. I. Stage of Stafford Springs, Connecticut, has been kind enough to allow use of his unpublished work (Stage, 1966) in the sections on Hesperapis and Xeralictoides. The descriptions of the new taxa involved are Stage's work and the new names are to be attributed to him.

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It is a pleasure to acknowledge the help of numerous people without whom this paper would be less complete. Dr. Les Greenberg examined the mouthparts of many short-tongued bees and thus provided the basis for my treatment of these structures. Mr. Robert W. Brooks did the computer work which assisted in preparation of cladograms.

As noted above, Dr. G. I. Stage permitted the inclusion of portions of an unpublished revision of Hesperapis and Xeralictoides (Stage, 1966); this allowed me to include here a consideration of all genera and subgenera of Melittidae. Dr. Stage's sections are appropriately marked and are his work, although imbedded in material by me.

For the loan of important material, including types, I am indebted especially to the late Dr. E. Königsmann of the Zoologisches Museum, Humboldt-Universität, Berlin; also to Dr. P. D. Hurd, Smithsonian Institution, Washington, D.C. and Dr. J. G. Rozen, Jr., American Museum of Natural History, New York City.

Mrs. Joetta Weaver assisted with editorial work and typed the manuscript. Mr. H. Harris of the Academic Computer Center of the University of Kansas assisted greatly in the computer preparation of camera-ready copy.

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METHODS

I have not sought to examine every species of every genus. For example, in genera like Melitta, Macropis, and Dasypoda, I have examined all available material and this represents a good sample of the described species. The current generic concepts seem acceptable and species not seen by me are probably correctly placed. Unfortunately in the fauna of southern Africa there exist species not available to me whose generic placement is uncertain.

In the descriptions, each character (or group of morphologically associated characters) is lettered. For coordinate, related taxa (e.g., the genera of a subfamily), a given variable (or group of variables) has the same letter in the description of each taxon. This system permits brevity of discussions and allows users to readily compare a given variable among all coordinate taxa. The lettering has no other meaning. In some cases a distinctive character found in only one genus is underlined, and to save space the alternative common character is not repeated for all other genera.

A substantial list (Table 1) of apomorphic characters is numbered and was used in cladogram-making. Characters may be referred to either by letters (which represent variables in coordinate taxa) or by numbers (which represent apomorphies or plesiomorphies relative to other Melittidae), or by both.

Terms for structures are essentially those used by Michener (1944, 1965), with a few minor and easily understood modifications for simplicity. Certain terms for mouthparts are derived from Winston (1979). Thus, instead of regarding paraglossae as two segmented, the term is limited to the distal "segment," the proximal one being the paraglossal suspensorium.

The only new term introduced for a structure is keirotrichia. These are the small hairs, usually of uniform length, blunt, spatulate, or bifid, occupying an area on the inner side of the hind tibia of most bees. The size of this area is a taxonomic character of interest. Occasionally the area is absent, scopal hairs covering the inner as well as the outer surface of the tibia.

Illustrations of mouthparts, genitalia, and associated sterna were prepared in a rather standardized way, although figures of certain structures are omitted for some taxa if similar structures are illustrated for related taxa, or if good illustrations are readily available elsewhere. For figures of inner views of maxillae, the whole maxilla was slightly flattened, usually by a gently pressing coverslip, so that the galea and stipes are in the same plane. The orientation of the lacinia was not at all standardized by this procedure, and apparent differences in the shape of the lacinia and adjacent parts of the galea are not meaningful. Various conventions used in drawing the anterior (or upper if the mouthparts are considered to extend forward) surface of the labium are mostly evident from the drawings. Thus the paraglossa and its suspensorium are shown on one side, the palpus on the other, and the position of the subligular process on the posterior surface is shown by broken lines. The basal fragmentum of the prementum has its distal end toward the viewer and basal end away; its shape as shown in the drawings depends so much on orientation that it means little.

Except in certain cases, as noted in figure captions, where dotted areas represent areas of dark pigmentation, dotted areas are membranous. Dots representing sensilla are larger and differently located.

CLADOGRAMS

Using a list of variables for which polarity (evolutionary direction) could be determined with greater or lesser confidence, I have developed a list of 102 apomorphic characters upon which are based cladograms for the supraspecific taxa. Polarity was ascertained (sometimes only tentatively) by consideration of related taxa (outgroups) (see Stevens, 1980). Thus hairy paraglossae occur in the outgroups that I have used for Melittidae, i.e., the Colletinae (including the Paracolletini) and the Andreninae. Within the Melittidae, therefore, this character is considered as plesiomorphic, and reduced abundance of paraglossal hairs as apomorphic. For the variable, paraglossal size, there is a trend from large (and hairy) to small, rudimentary, and even absent. Such a series obviously involves increasingly apomorphic steps since the structure is one that is well developed in many insect orders and in other families of bees. Similar considerations apply for many variables having only two characters. The last antennal segments in most Hymenoptera are subcylindrical. They are broadly expanded and flat in males of Ceratonomia, slender and hooked in Meganomia. These are two obvious apomorphies. Frequency (i.e., distribution among taxa) of a character within a group is not a suitable indication of its plesiomorphy or apomorphy. However, a frequent character in outgroups is likely to be plesiomorphic in the taxon under study and its alternative, therefore, is likely to be apomorphic. A character associated with a known plesiomorphy, especially in outgroups, is also likely to be itself plesiomorphic, the alternative of the

variable therefore apomorphic.

Table 1 is a list of 102 apomorphic characters, with parenthetical notes on the distribution of plesiomorphies of the same variables and on the basis for my judgement as to polarity within each variable. Such information is frequently abbreviated, but should be sufficient to suggest reasons for decisions on polarity of each variable. Essentially similar methods were used by Stage for his section on Hesperapis.

TABLE 1. LIST OF APOMORPHIES (SEE TABLE 3 FOR APOMORPHIES WITHIN HESPERAPIS GROUP).

1. Head, thorax, and abdomen with yellow integumental markings. [Such yellow markings, suggestive of the Anthidiini, occur in various groups of bees but not in the out groups for Melittidae; they appear to be clearly derived where present among melittids.]
2. Clypeus of male largely yellow. [A yellow clypeus occurs in males of many bees, including members of all major families except Megachilidae. However, a black (concolorous) clypeus is more common, and occurs in the great majority of such probably primitive groups as Colletinae. It is a weak variable for our purposes not only because it seems to have arisen repeatedly among bees but because there is a possibility that the polarity is misinterpreted. In addition to the genera shown to have this character in the cladograms, the lower half of the clypeus is yellow in males of Hesperapis (Zacesta) rufipes.]
3. Mandible of female simple. [This character occurs in a few other groups of bees (e.g., Panurginae) but is in every case evidently derived from the widespread, common type of mandible with a preapical tooth (apex of the pollex, Michener and Fraser, 1978) on the upper margin.]
4. Mandible of female modified as long, broad blade. [A unique structure found only in Dolichochoile.]
5. Mandible of female tridentate. [In Melittidae found only in Haplosamba; a rare and derived feature in the outgroups also.]
6. Mandible of male simple, without preapical tooth, although with flaring upper edge. [Although a flaring edge, with evidence of tooth (apex of pollex) remaining, occurs in some species of both Hesperapis and Capicola, the apomorphy as stated is unique to Xeralictoides.]
7. Hind femur with subapical pit on inner surface. [A unique feature found only in Xeralictoides.]
8. Paraglossa with reduced pubescence, largely hairless. [In nearly all bees, as well as in many other Hymenoptera, the paraglossae are densely hairy and often annulate like the glossa. They are smaller in melittids than in most bees, and nearly hairless in Dasypodinae.]

9. Paraglossa much shorter than suspensorium. [The paraglossa is at least about as long as its suspensorium in most other Hymenoptera including the out groups. This character involves progression beyond 8.]
10. Paraglossa short, small, cylindrical. [See character 9. Character 10 involves progression beyond 9.]
11. Paraglossa short, small tapering. [See character 9. Character 11 involves progression beyond 9; probably is not derived from 10.]
12. Paraglossa virtually absent. [See character 9. Character 12 involves progression beyond 11.]
13. Galeal blade not notched preapically. [A preapical notch is found in the out groups as well as many halictids. Its presence is therefore presumed to be plesiomorphic. However, there is always the possibility of convergent origin of the notch in different taxa; in this case the polarity should be reversed.]
14. Galeal comb reduced to 3-6 teeth. [Outgroups have combs of 9-18 teeth.]
15. Galeal comb absent. [See character 14.]
16. Stipes with flange along posterior margin, at least apically where it is broad and rounded. [Such a flange unknown except in *Sambini*.]
17. Stipes with flange extending the whole length of stipes. [A step beyond character 16.]
18. Posterior margin of stipes with large, preapical concavity. [Such a concavity is very familiar in long-tongued bees, often margined with a comb, but is not known in other short-tongued bees except the ctenoplectrids.]
19. Maxillary palpus very short, incompletely two-segmented. [This palpus is six-segmented in other melittids and in the out groups.]
20. Distal third of prementum membranous. [This feature is not known in other bees or wasps.]
21. Mentum membranous. [This feature is found in no melittids except *Samba*. Other bees that have a reduced or membranous mentum show quite a different and presumably independently evolved reduction.]
22. Labial palpus short (as in *Dolichochile*). [This feature is unique to *Dolichochile*.]
23. Maxillary palpus with long setae. [The short setae found in all others (including out groups) are much elongated in *Prosamba*.]

24. Labrum with lateral lobes. [Such lobes are not found in the outgroups or in melittids other than Melitta and Dolichochile.]
25. Clypeus with median ridge. [This is a weak character because it occurs in scattered groups of bees and wasps, often as a specific character. It appears to be an apomorphy in the two groups of melittids that exhibit it.]
26. Clypeal apex trilobed. [This feature is associated with the very short clypeal truncation which is the median lobe. Such a clypeus is not found in outgroups or melittids other than Meganomiinae.]
27. Vertex convex seen from front, elevated well above summits of eyes (sometimes apparently secondarily concave although elevated.) [The high, convex vertex is found in certain other bees (e.g., the Melitomini of the subfamily Anthophorinae) but is a scattered, rare phenomenon in the out groups. Presumably the plesiomorphic character of this variable is a rather flat vertex, with the ocellar area somewhat elevated.]
28. Vertex concave seen from front. [See character 27.]
29. Face of female much broader than length of eye. [The extraordinarily wide, low head of Samba is unique among bees.]
30. Flagellar apex of male expanded. [The plesiomorphic condition is a simple, rounded last antennal segment, as in most wasps and bees.]
31. Flagellar apex of male hooked. [See character 30.]
32. Flagellum of male flattened, with long hairs on under side. [Cylindrical segments with very short hairs are very widespread and certainly plesiomorphic.]
33. Mesoscutal hairs scale-like. [Slender, often sparsely and rather briefly plumose hairs are characteristic of most melittids and the outgroups, and are doubtless plesiomorphic.]
34. Hairs extraordinarily densely plumose. [See character 33.]
35. Upper metapleural pit difficult to recognize because it is close and somewhat posterior to lower pit. [Widely separated pits, one far above the other, characterize the outgroups and most melittids.]
36. Front coxa with apical hairy spine or lobe. [Similar projections are found in a few other bees but not in the outgroups.]
37. Third trochanter of female angulate beneath. [Such modification of the trochanter of the female is unusual, scarcely found in the outgroups.]

38. Anterior femur of male with basal process. [Among melittids such a process occurs only in Ceratomonía; similar structures are not known in the outgroups.]
39. Hind femur of male swollen. [Similar enlargement occurs in various other bees but rarely if at all in the outgroups.]
40. Basitibial plate of female not defined apically, hidden under pubescence. [Well defined basitibial plates characterize females of most burrowing bees including the outgroups and most melittids.]
41. Basitibial plate of female absent. [See character 40.]
42. Hind tibia of female with apical bare area on outer surface. [Such an area is not found in the outgroups.]
43. Front tibia with several large teeth on outer surface apically and subapically. [This is a unique feature known only in Xeralictoides.]
44. Middle tibial spur of female short, robust. [This spur is slender and gently curved in nearly all bees.]
45. Middle tibial spur of female strongly hooked apically. [See character 44.]
46. Female with only one hind tibial spur. [Comparable loss of one spur and enlargement of the other is not known in female bees other than Samba.]
47. Male with inner hind tibial spur much elongated, curved backward, hairy. [This is a unique modification known only in Prosamba.]
48. Hind tibia and basitarsus of female broad. [This character is not found in the outgroups, and may be related to oil transport.]
49. Scopa plumose with emergent, long, bare hairs. [Comments same as for character 48.]
50. Limited plumose hairs under long simple scopal hairs. [This feature occurs in various bees but in melittids is restricted to a few groups and the basis of correlated attributes is derived.]
51. Apex of hind basitarsus of female with hairs parted. [Such divergence of hairs is not found in the outgroups. This character is not the same as the parting of hairs along the upper (= posterior) margin of the basitarsus in females of some Hesperapis.]
52. Front tarsus of female with dense, short hairs. [This type of vestiture is not found in outgroups and is presumably related to oil collecting.]

53. Posterior basitarsus of female with small apical projection or tooth above articulation of second tarsal segment. [Such a tooth is rather widespread among bees and could be plesiomorphic for Apoidea, although certainly apomorphic for Aculeata, for it is lacking in wasps.]
54. Posterior basitarsus of female with long apical projection or process above articulation of second tarsal segment. [This progressive development of character 53 is found in only a few taxa.]
55. Hind basitarsus of male with comb and apical process. [Equivalent structures are not found in other bees.]
56. Hind basitarsus of male inflated. [This is an unusual character, not shared by bees in the outgroups.]
57. Hind basitarsus of male with hairy pocket on outer side near base. [This character is unknown in bees other than Samba.]
58. Claws with inner rami broad and truncated on hind (sometimes middle) leg. [Claws in the outgroups and most melittids each have a strong, acutely pointed inner tooth or ramus.]
59. Claws with inner rami broad and truncated on all legs. [See character 58. This is a progressive extension of character 58.]
60. Claws of female with inner rami represented by strong tooth. [See character 58.]
61. Claws of female with inner rami minute or absent. [See character 58. This is a progressive extension of character 60.]
62. Arolia absent. [Loss of arolia occurs in a few other scattered groups of bees but not in bees that resemble melittids. It is unusual in this case in that associated structures remain rather well developed.]
63. Tibia of female with short, blunt, coarse hairs scattered among scopal hairs. [This feature is not known in the outgroups.]
64. Second transverse cubital vein absent, so that there are only two submarginal cells. [Loss of this vein is a widespread common apomorphy in wasps and bees.]
65. Base of second submarginal cell more or less transverse. [This is an unsatisfying character since it is rather variable; even individual variations in positions of vein intersections can influence the slope of the first transverse cubital vein. Nonetheless the character is in general useful. It is uncommon in the outgroups but is characteristic of the paracolletine genus Scapter.]

66. Mesoscutum as long as or longer than intertegular distance. [This character, found in Xeralictoides, does not occur in other melittids.]
67. Stigma very slender. [This character is not uncommon in large bees; it appears to have arisen independently in various families.]
68. Stigma very broad. [This character is common in minute bees and must have arisen independently in various families.]
69. Prestigma longer than stigma. [Same comment as for character 67.]
70. Prestigma much shorter than stigma. [Same comment as for character 68.]
71. Jugal lobe about half as long as vannal lobe. [In the outgroups, at least in presumably primitive members of them, the jugal lobe is long, two thirds or three fourths as long as the vannal lobe. The long lobe is therefore presumably plesiomorphous in Melittidae.]
72. Jugal lobe less than half as long as vannal lobe. [See character 71, of which this is a progressive extension.]
73. Profile of propodeum all more or less in one plane. [In the presumably more primitive genera in the outgroups, the anterior third to fifth of the profile is more nearly horizontal than the more posterior or declivous part.]
74. Profile of propodeum half horizontal. [See comment under character 73.]
75. Propodeal triangle small. [The triangle is rather large in nearly all bees, including most members of both outgroups.]
76. Propodeal triangle partly hairy. [This is a rare feature in short-tongued bees. As explained in the discussion of Sinomacropis, this could be morphologically the same as character 75.]
77. Metasomal terga without apical hair bands. [Apical hair bands are widespread among bees including many members of the outgroups. Their presence is probably plesiomorphic.]
78. Metasomal terga with basal hair bands. [Basal hair bands suggestive of those of the halictid genus Lasioglossum, are rare or absent in the outgroups and must be an apomorphy in melittids.]
79. Tergal graduli bent posteriorly at each side but terminating roughly half way from bend to marginal zone of tergum. [This condition is rather common in bees and could be plesiomorphic. However, it seems that it is not common in the outgroups and it is tentatively regarded as apomorphic.]

80. Tergal graduli strongly continuing to rear at each side, reaching or nearly reaching marginal zone. [This is a progressive extension of character 79, and its rarity supports the view that it is apomorphic.]
81. Male with "stridulatory areas" on bases of certain terga. [Such areas are unknown in other bees.]
82. Prepygidial fascia of female absent. [A dense band of hairs on the fifth tergum is characteristic of nearly all burrowing bees. Its loss is a remarkable apomorphy of Eremophanta.]
83. Pygidial plate of female with longitudinal median elevated area, or at least with ridges marking the edges of such an area. [Such an elevated area, extending more or less the full length of the plate, is not found in the outgroups.]
84. Pygidial plate of male reduced (poorly defined.) [The pygidial plate is widespread and doubtless plesiomorphic in bees. It is more often ill-defined or lost in males than in females.]
85. Pygidial plate of male absent. [This is a progressive extension of character 84. Reversal is possible, probably because genes specifying the plate are retained in females and have only to be activated in males.]
86. Sternum V of male with apical comb. [A comparable comb is not found in similar bees.]
87. Latero-apical lobes of sternum VII of male sclerotized, in same plane as body of sternum, directed laterobasad, one pair only. [See comments on character 88.]
88. Disc of sternum VII of male a broad plate, almost like preceding sterna. [Widespread among the presumably primitive families of bees is the type of sternum VII in which the disc is reduced to a narrow base from which arise two pairs of usually long, almost membranous, lateroapical lobes, the upper pair with hairs on the lower surface and the lower pair with hairs on the upper surface. Such elaborate, similar structures are unlikely to have arisen independently; hence this condition is presumably plesiomorphic for bees. A broad plate must therefore be an apomorphy.]
89. Sternum VII of male with latero-apical lobes reduced. [See comments on character 88.]
90. Sternum VII of male without distinct latero-apical lobes. [See comments on character 88. This is a progressive extension of character 89.]
91. Gonocoxite of male abruptly broadened at base. [This is an attribute not found in other bees.]

92. Gonocoxite of male with mesoapical, apically produced lobe. [Such a lobe occurs in some other bees but is weaker; it is virtually absent in melittids other than Sambini.]
93. Gonostylus short, broadly fused to gonocoxite. [I make the assumption that a more or less articulated, moveable stylus is primitive. For insects this is obviously true, but it could be that for bees it is a reversion, for the broadly fused gonostylus is common.]
94. Gonostylus enlarged and at least biangulate apically. [This feature is not found in related bees nor in styli in general. It must be apomorphic.]
95. Gonostylus deeply bifid. [Same comment as for character 94.]
96. Gonoforceps with inner lobe, often cylindrical, usually bearing long, coarse bristles or hairs. [Such an inner lobe is not known in other bees. Its presence must be an apomorphy.]
97. Volsella with digitis much elongated, not opposable to cuspis. [Digitus and cuspis of about the same length and with opposable denticles are characteristic of most Hymenoptera including the outgroups. The elongated digitus must be apomorphic.]
98. Volsella much reduced, without recognizable digitis and cuspis. [See comments under character 97.]
99. Penis valve grotesque, with both upward and downward projecting processes. [Such processes are absent or feebly developed in the outgroups as well as most melittids.]
100. Gonostylus with defined area of dense setae on outer surface. [Such an area does not occur in other melittids.]
101. First sternum of female highly modified. [No other bee has an equivalent modification. It must be an apomorphy.]
102. Antenna of male 14-segmented. [Antennae are 13-segmented not only in other male bees but throughout the aculeata.]

Using the characters listed in Table 1, and a tabulation of characters of the variables for all taxa, cladograms were prepared (Figs. 1, 2). A computer program by J. S. Farris (1970) was used to order the taxa and characters and to prepare preliminary cladograms. Differences between Figures 1 and 2 result from different considerations, not all of which are worth discussing in detail. In Figure 1 Rediviva and Macropis have a common stem because of characters 48, 49, 51, and 52, all of which are perhaps related to oil collecting and oil transport. This arrangement separates Rediviva and Redivivoides, but then these two genera have four convergent apomorphies, 72, 75, 89, and 93. Figure 2 reverses the arrangement, placing Rediviva and Redivivoides on the same stem, and showing the oil-manipulating

characters as convergent in Macropis and Rediviva. In spite of the number and detailed similarity of these characters, I suspect that the relationships are better shown in Figure 2.

Figures 1 and 2 also differ in the sequence of branches in the Meganomiinae. The relations among the four very distinctive genera are indicated by very few synapomorphies, only three in each figure. Although these characters seem strong, they differ in the two figures, and a conservative cladogram based on present knowledge would probably show all four meganomiine genera arising from a common point.

The difference in the basal furcation of the cladogram in Figures 1 and 2 depends only on the emphasis placed on character 13, loss of the preapical notch of the galea. Figure 1 assumes it happened twice, which is likely considering that it has happened in other groups of bees and that the notch is bridged by transparent material, thus partly lost, in Ceratonomia, and moreover is completely lost in one species of Meganomia.

The grouping of apomorphies on certain stems in Figures 1 and 2 gives some idea of the distinctiveness of the various groups. The autapomorphies could always be multiplied, especially for taxa containing only one species in which one has only to search for more characters. Synapomorphies are less easily increased in number. It is impossible to find all the characters, and I believe that those shown in Figures 1 and 2 are a representative sample which show that the Meganomiinae, each meganomiine genus, Macropis, Melitta-Dolichochile, Eremaphanta, Samba, and the Sambini are all strikingly distinctive taxa.

At the opposite extreme, there are some terminal branches with no characters marked on them, e.g., Macropis s. str. in both Figures 1 and 2. As indicated the taxonomic treatment, there are other differences, sometimes characters whose polarity is obscure and which therefore could not be used in the cladistic study. It must be remembered that lack of characters, e.g., on the Macropis s. str. line, is not really true; the plesiomorphic alternatives of the apomorphies shown for the sister group characterize the seemingly character-free taxa. Probably the unmarked lines represent paraphyletic taxa, i.e., Macropis s. str. is probably the group from which Sinomacropis evolved. I have no problem with this idea. Those who wish classifications and cladograms to be completely redundant and who do not recognize paraphyletic taxa would have to develop a different classification (based on which cladogram?).

Comparison of the cladograms shown in Figures 1 and 2 with cladograms based on larval characters prepared by Rozen (1978) shows major similarities. Rozen studied larvae of Meganomia, Melitta, Macropis, Dasypoda, Capicola, and Hesperapis (as well as Ctenoplectra, now placed in the family Ctenoplectridae). His cladograms are exactly concordant with Figure 2 except that Ctenoplectra branches from the Meganomia stem. Rozen notes, however, that "the apparent closeness between Ctenoplectra on the one hand and Meganomia, Melitta, and Macropis on the other, is spurious in that Ctenoplectra differs by many features, the plesiomorphic-apomorphic polarity of which cannot be determined." The reasons for separating Ctenoplectra into a family distinct from the Melittidae are adult characters listed by Michener and Greenberg (1980).

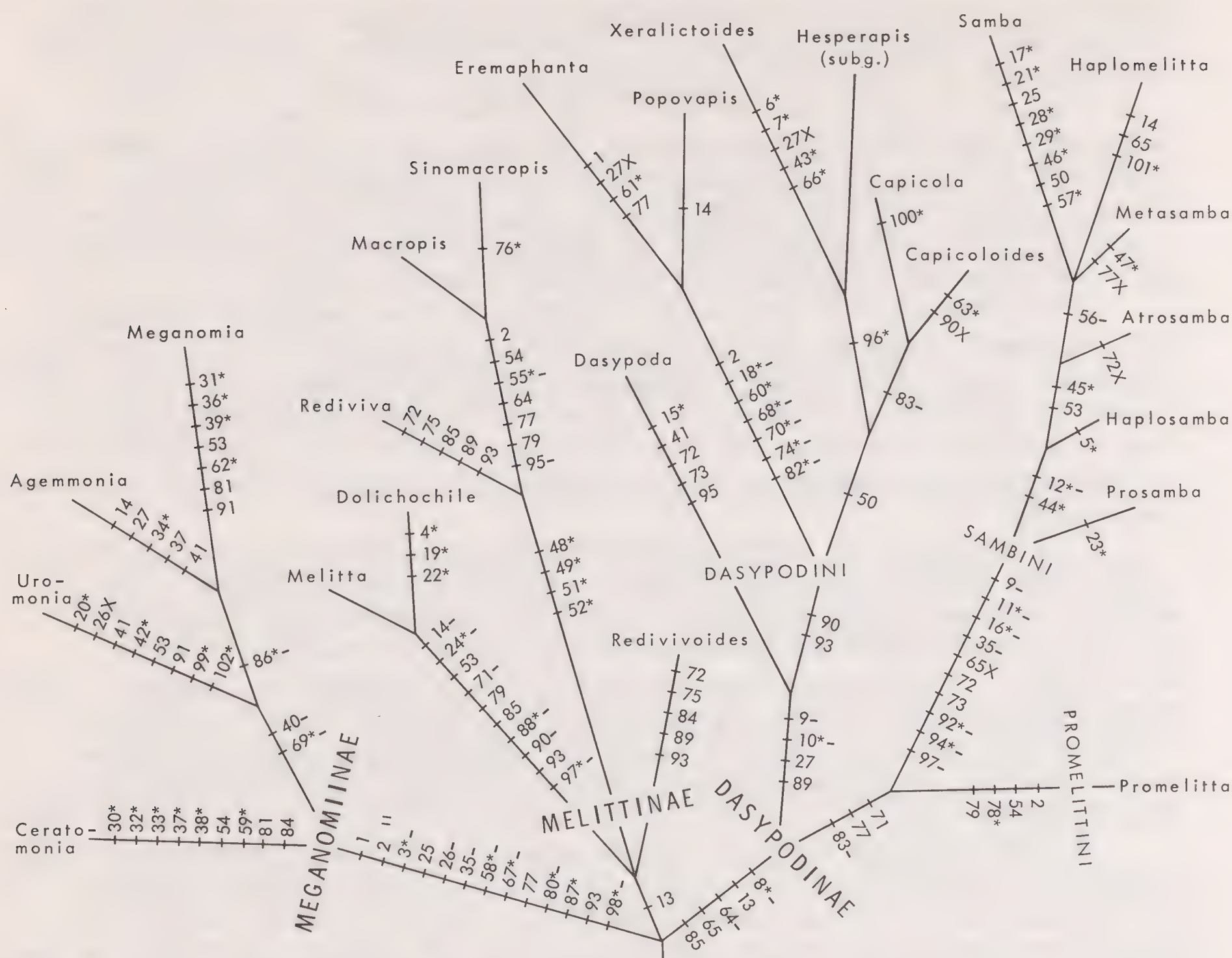


Figure 1. Cladogram for the genera and subgenera (except for *Hesperapis*) of Melittidae. (*Paramacropis* is omitted, being insufficiently known; *Haplosamba* is placed only on the basis of female characters.) The numbers represent apomorphies listed in Table 1. Asterisks indicate characters not appearing elsewhere in the Melittidae. A dash beside a number indicates that it represents a strong character, whose polarity is unlikely to be misunderstood. An x after a number indicates a reversion to what looks like the plesiomorphic condition. Lines without indications of apomorphies lead to presumably paraphyletic taxa.

Family Melittidae

Diagnosis. Short-tongued bees (i.e., with labial palpal segments similar and cylindrical, the first two not elongate and sheath-like) without glossal flabellum; mentum tapering basally and curled over v-shaped lorum as in long-tongued families; galeal comb usually present; mesepisternal disc with system of grooves represented only by groove from scrobe to posterior margin of mesepisternum; scopa limited to posterior tibia and basitarsis; volsella present.

Description. a. Labrum usually much broader than long, apical margin in both sexes fringed with bristles. b. One subantennal suture

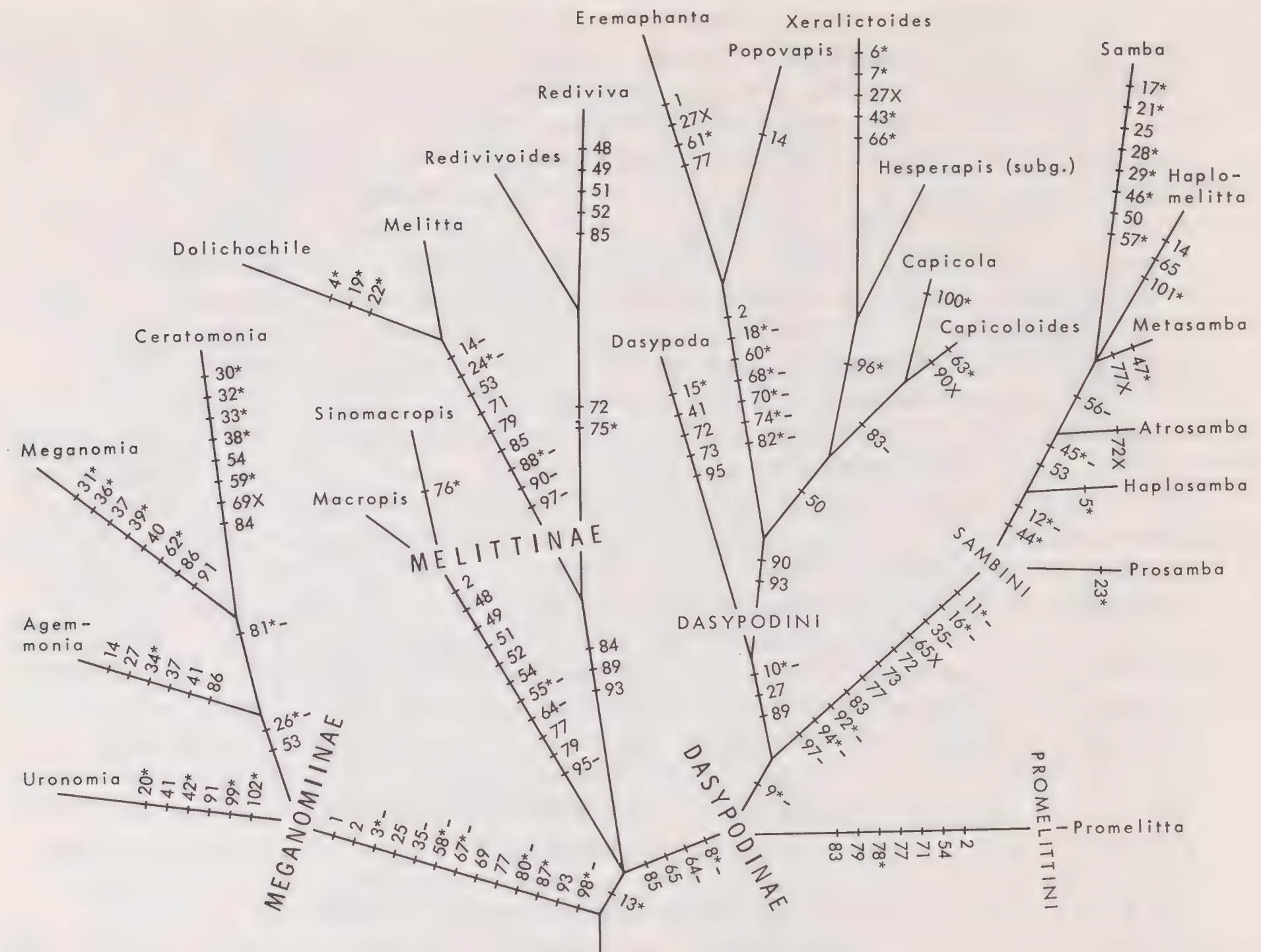


Figure 2. A second cladogram for genera and subgenera of Melittidae, using the same characters as for Figure 1, but making different assumptions in various parts of the tree about which are convergent. Explanation as for Figure 1.

below each antenna, its upper end directed toward middle of antennal socket or toward either inner or outer margin of socket. c. Facial fovea absent. d. Lower lateral parts of clypeus not much bent posteriorly on either side of labrum. e. Glossa usually shorter than prementum. f. Apex of glossa pointed, usually attenuate. g. Apex of glossa with branched hairs. h. Flabellum absent. i. Posterior surface of glossa with depression or shallow groove; hairs margining depression or groove similar to nearby glossal hairs, not short as in forms with a deep groove. j. Glossal rod absent. k. Paraglossa usually small, sometimes absent, commonly shorter than suspensorium except in Meganomiinae, if densely hairy, with branched hairs at apex. l. Labial palpus with first two segments more or less cylindrical, not sheath-like; third and fourth segments in line with the first two, not projecting laterally. m. Sublingual process of prementum not strongly curved anteriorly, a pair of scarcely sclerotized bands diverging from its apex and extending toward lower margins of paraglossal suspensoria. n. Ligular arms of prementum distinct, not or incompletely fused to margins of premental sclerite, bases near base of prementum. o. Mentum elongate, tapering basally, curled over the lorum to its articulation with the latter, usually well sclerotized (not sclerotized in Samba).

p. Apex of mentum articulated with prementum via a detached basal fragmentum of the prementum; base of fragmentum directed posteriorly so that fragmentum is at a strong angle to axis of prementum. q. Lorum well sclerotized, slender, strongly v-shaped, apices of its arms lying on the cardines only slightly above the cardo-stipital articulations. r. Galeal blade usually equal to or shorter than stipes, usually much longer than prepalpal part of galea. s. Galeal comb present (reduced in *Melitta*, greatly reduced in *Dolichochile*, absent or essentially so in *Dasypoda*); stipital comb and its concavity absent (concavity distinct in *Eremaphanta*). t. Basistipital process somewhat elongate (short in *Macropis*). u. Pre-episternal groove absent, as is scrobal groove in front of pleural scrobe, so that the only strong groove on disc of mesepisternum is that between scrobe and meso-metapleural intersegmental suture. v. Mid coxa fully exposed, nearly reaching lower metapleural pit, shorter than or equal to distance from summit of coxa to summit of metapleuron. w. Upper metapleural pit above to below midpoint between summit of mid coxa and hind wing base. x. Metapostnotum (propodeal triangle) hairless. (A possible exception, with what appears to be a partially hairy metapostnotum, occurs in *Sinomacropis*.) y. Oblique brush on under side of mid tibia of female (tibial comb of Jander, 1976) present, sometimes weak. z. Basitibial plate of female usually distinct, of male often distinct. aa. Scopa restricted to hind tibia and basitarsus. bb. Jugal lobe of hind wing one fourth to three fourths as long as vannal lobe, both measured from wing base. cc. Volsella present (much reduced in *Meganomiinae*). dd. Penis valves rarely fused dorsally, not forming a distinct spatha. ee. Pygidial plate of female present; pygidial and prepygidial fimbriae of female present except in *Eremaphanta*, prepygidial fimbria reduced to mere hair band in some other *Dasypodini*; pygidial plate of male frequently absent. ff. Mandibular cusp of larva multidentate, apical concavity scoop-like (Rozen and McGinley, 1974; Rozen, 1977).

Comments. No known character is both unique to the Melittidae and a feature of all melittids. However, the combination of a short proboscis (characters e, r, and especially l) with the form of the lorum and mentum (characters o, q, as in long-tongued bees) separates Melittidae and Ctenoplectridae from all other bees. The Melittidae differs from Ctenoplectridae not only in the glossa (characters e, g, h) and the presence of a galeal and lack of a stipital comb (character s), but also in other characters listed below and in lacking the numerous special synapomorphies of the Ctenoplectridae listed by Michener and Greenberg (1980).

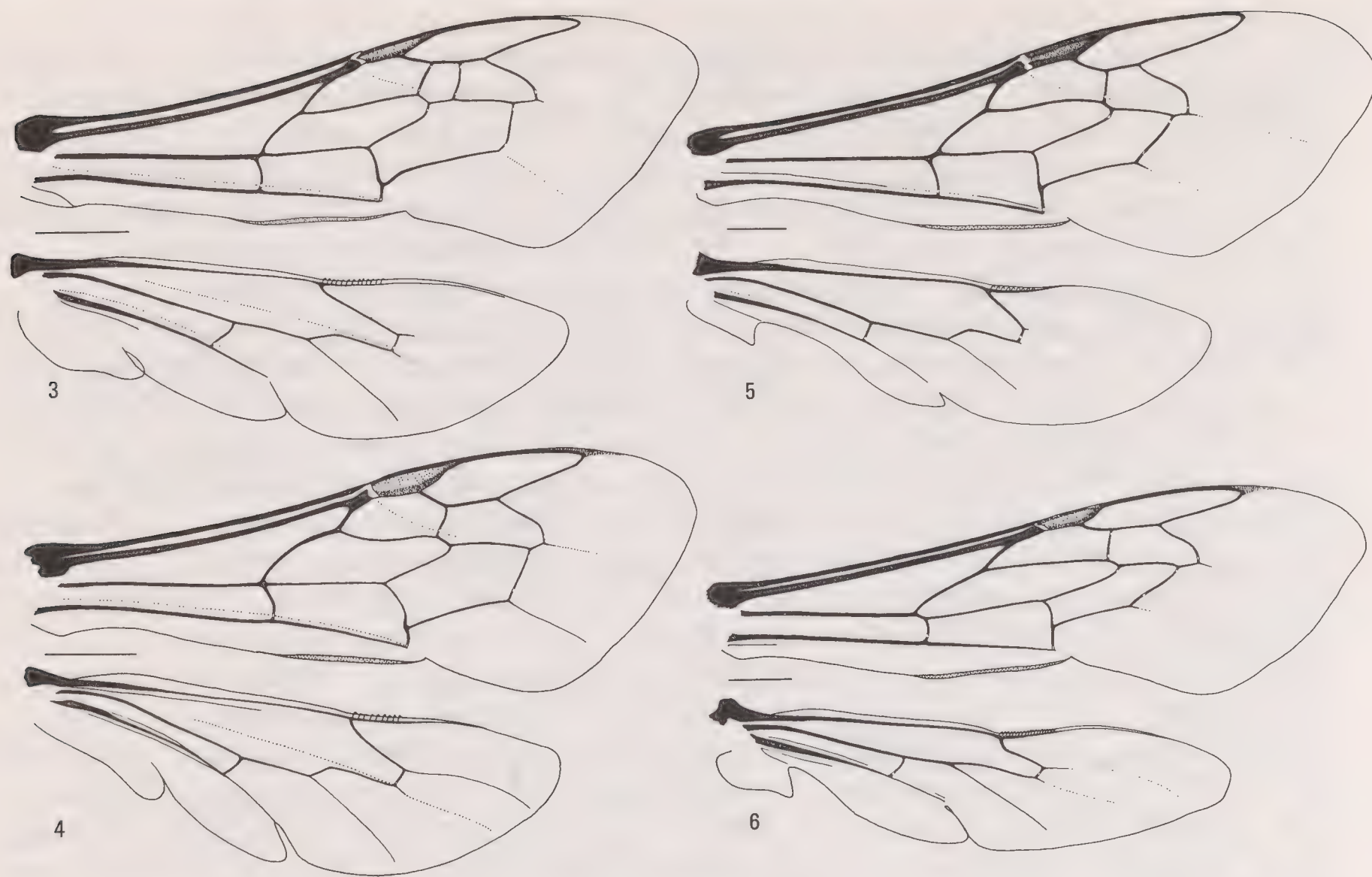
As detailed by Michener and Greenberg (1980), characters o, p, q, t, u, v, w, and aa distinguish the Melittidae from the short-tongued families Andrenidae, Colletidae, Halictidae, Oxaeidae, and Stenotritidae. Of these, characters o, p, q, t, v, and aa are shared with the Ctenoplectridae and long-tongued families. Most of these characters are not found elsewhere in Hymenoptera and are thus synapomorphies of the group consisting of Melittidae, Ctenoplectridae, and the long-tongued families of bees. The Melittidae differs from the Ctenoplectridae in characters g, h, i, m, s, u, cc, and dd; the Ctenoplectridae shares the alternatives of most of these characters with the long-tongued bees.

As to synapomorphies of the Melittidae alone, one can only cite characters k and u, neither of which is very convincing. The paraglos-

sae do tend to be small in Melittidae, but are larger in the Meganomiinae than in other subfamilies. They are as small as in most melittids in certain Andrenidae. Reduction in size could thus have occurred independently, and in any event the difference in paraglossal size between that of Meganomiinae and that common in other short-tongued families of bees is not great. The loss of mesepisternal grooves is more convincing but is duplicated in certain other bees (most Megachilidae, some Andrenidae), showing that it could be a convergence. The loss of the grooves, therefore, could have occurred independently in various melittid groups, although there is no evidence for this idea. It is thus possible that there is no true melittid synapomorphy, in which case Melittidae is not the sister group of the Ctenoplectridae plus long-tongued (C L-T) bees, but is the paraphyletic group from which C L-T bees arose. The Melittidae is nonetheless a phenetically compact group, presumably monophyletic (in the usual, not the Hennigian, sense). It may well be paraphyletic, however, in the sense that pre-ctenoplectrids arose from bees that, if known to us, would be placed in Melittidae. The short-tongued families Colletidae, Halictidae, Andrenidae, and Stenotritidae may also have arisen from bees that would be placed in the Melittidae. A cladogram showing the relationships of the families that fall between the major short-tongued families and the long-tongued families, assuming that Melittidae and C L-T bees are sister groups, is given by Michener and Greenberg (1980).

Key to the Subfamilies of Melittidae

1. With yellow or cream markings on head, thorax, and metasoma; apex of marginal cell rounded, bent away from wing margin.
-----Meganomiinae
- Yellow or cream markings, if present at all, limited except in Eremaphanta to face in male and absent in female; apex of marginal cell pointed, on or very near wing margin.
-----2
2. Paraglossa largely bare, usually markedly shorter than suspensorium, hairs largely limited to apex, or paraglossa absent; forewing with two submarginal cells, second usually shorter than first, first transverse cubital (= base of second submarginal cell) usually more or less at right angles to longitudinal veins (Figs. 5, 6) and usually close to first recurrent vein. Known larvae do not spin cocoons.
-----Dasypodinae
- Paraglossa densely hairy; forewing with two or three submarginal cells, second (if only two cells) or second plus third as long as or longer than first, first transverse cubital (= base of second submarginal cell) slanting, usually well separated from first recurrent vein (Figs. 3, 4). Larvae spin cocoons.
-----Melittinae



Figures 3-6. Wings of Melittidae. 3, Melitta leporina (Panzer). 4, Macropis labiata (Fabricius). 5, Hesperapis pellucida Cockerell; 6, Dasypoda panzeri Spinola. Scale lines = 1.0 mm.

Meganomiinae new subfamily

Diagnosis. Differs from other subfamilies, except for minute bees of the genus Eremaphanta in the Dasypodini, in having yellow or ivory maculations not only on face but elsewhere on head, thorax, and metasoma; in the slender, parallel-sided stigma; and in the much reduced volsella without recognizable digitis and cuspis.

Description. a. Head, thorax, and metasoma with yellow or cream-colored maculations. b. Mandible of female simple, of male simple or with extreme apex slightly bidentate because pollex extends nearly to apex of rutellum or with pollex shorter than rutellum and ending in a subapical mandibular tooth. c. Paraglossa longer than its suspensorium, densely hairy with annuli similar to those of glossa. d. Galeal blade with preapical notch or slit on posterior margin, filled by transparent material in Ceratomonina (Fig. 10), this notch or slit absent in Meganomia rossi. e. Labrum much broader than long, that of female except in Ceratomonina with sharp transverse ridge, beyond which is a concavity extending to the depressed apical part. f. Frontal carina on a strongly raised, roof-like ridge in the region between antennae. g. Malar area linear. h. Clypeus with a longitudinal median ridge, at least partly shiny and not or sparsely punctate. i. Propodeal triangle dull, granular (rather shiny in Meganomia rossi), rather large, nearly as wide as width of propodeum, declivous but basal part not so steeply sloping as distal part. j. Forewing with three submarginal cells, usually second and always third narrowed toward

costal margin, second and third together shorter than or as long as first. k. Basal vein over twice (usually over three times) as long as first abscissa of Rs. l. Stigma extremely slender (Fig. 57), prestigma two thirds as long as stigma to longer than stigma; vein r arising near apex of stigma, sides of stigma basal to vein r parallel or even converging apically. m. Apex of marginal cell rounded, bent away from wing margin. n. Jugal lobe of hind wing about two thirds as long as vannal lobe or somewhat shorter, but always over half length of vannal lobe. o. Mid and hind basitarsi of both sexes narrower than tibiae. p. Hind basitarsus of female tapering distally, apex except in Ceratonomia giving rise to segment 2 more or less medially and not much produced distally above base of second segment. q. Metasomal terga without apical hair bands, except for strong prepygidial and pygidial fimbriae (terga V and VI). r. Metasomal terga I-IV of females and I-V of males with broad, nearly impunctate apical bands, depressed below level of rest of tergum all the way across. s. Lateral extremities of the tergal graduli bent posteriorly and continuing as strong longitudinal carinae nearly to posterior margins of terga. t. Pygidial plate of male present. u. Seventh sternum of male with a pair of sclerotized apical lobes arising medially and extending laterally or anterolaterally, often in contact with disc of sternum (so that one may not immediately see that lobes join the sternum only near the midline). v. Eighth sternum of male without well defined bevelled or truncate apical plate, although sometimes with an indication of such a plate. w. Volsella much reduced, not at all chelate. x. Gonostylus indistinguishably fused to gonocoxite.

Comments. The Meganomiinae contains bees rich in specialized features. Synapomorphies of the subfamily include characters a, b (simple mandible of female), h, l, q, r, s, and w. All of these are absent or nearly so in other Melittidae and related short-tongued bees. On the other hand, the subfamily retains various ancestral characters, recognized by their widespread occurrence in related families of short-tongued bees. Such plesiomorphies are characters c, d, j, n, o, p, and t. Of these c and d are the most meaningful, as the rest occur also in certain other melittids.

Rozen (1977, p. 14) suggests subfamilial status for the group on the basis of larval synapomorphies.

The Meganomiinae contains four genera, all from eastern or southern Africa, that are very different morphologically. They are Meganomia, Agemmonia, Uromonia, and Ceratonomia. Each genus seems about equally different from the other three, largely due to the specialized derived features of each. Figures 1 and 2 show two different cladograms for the subfamily, almost equally parsimonious in character changes (44 vs. 43). The discordance of the distribution of the synapomorphies indicated shows that some of them either evolved independently in different genera or, after evolving, were lost in certain descendant genera.

Key to the Genera of Meganomiinae

1. Arolia absent (although long, hairy, yellow planta projects between the claws); flagellum of male with apical segment curled and attenuate (Figs. 49-52, 55, 56); hind basitarsus of male bent or contorted, or at least with curved carina on outer side.

-----Meganomia

- Arolia present, conspicuously black among associated pale interungual structures; flagellum of male with apex simple or expanded as a plate; hind basitarsus of male simple.

-----2

2. Upper part of head gently convex seen from front; ocelli much in front of posterior edge of vertex (Fig. 58), posterior ocellus separated from that edge by several ocellar diameters and front edge of median ocellus nearer to antennal bases than to posterior edge of vertex; inner orbits diverging below; first flagellar segment over four times as long as broad; glossa as long as prementum.

-----Agemmonia

- Upper part of head seen from front flat or with ocellar region slightly elevated; posterior ocellus separated from posterior edge of vertex by an ocellar diameter or little more; front edge of median ocellus much nearer to posterior edge of vertex than to antennal bases; inner orbits converging below, at least in upper halves; first flagellar segment less than three times as long as wide; glossa less than half as long as prementum.

-----3

3. Basitibial plate of female not defined; flagellum of male simple; terga IV and V without sublateral stridulating areas; penis valve of male enormously developed with dorsal and ventral processes.

-----Uromonia

- Basitibial plate of female well defined; flagellum of male with apical segment expanded, plate-like, black; terga IV and V with sublateral stridulating areas hidden under preceding tergal margins; penis valve of male of ordinary slender form.

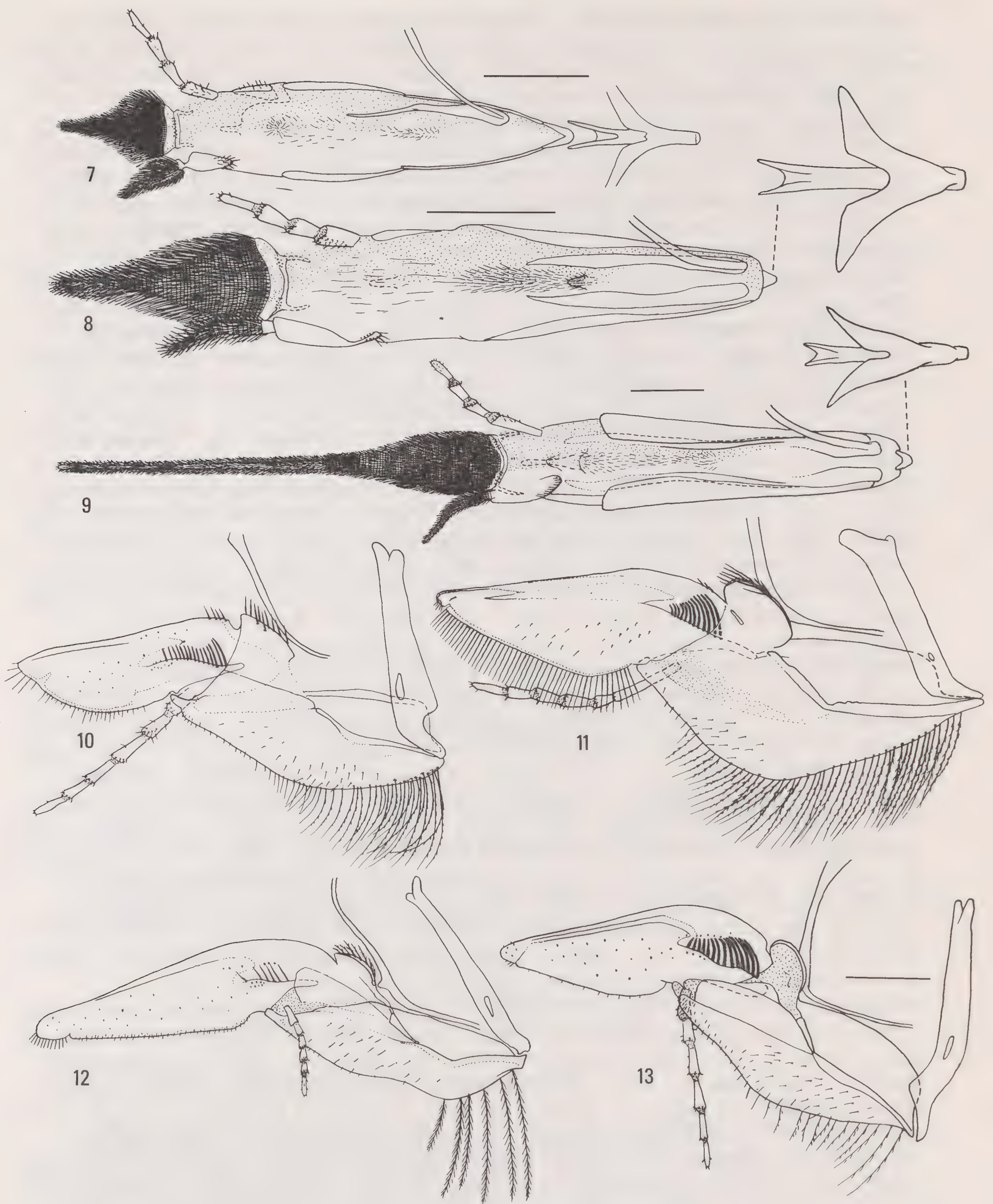
-----Ceratonomia

Ceratonomia Michener new genus
(Figs. 7, 10, 14-18, 47, 48, 57, 58, 198)

Type species: Ceratonomia rozenorum new species.

Diagnosis. Male flagellum long, flat, hairy beneath; last segment expanded, discoid; basitibial plate of female well defined, conspicuous; labrum a transverse strip, not produced medially; arolia present.

Description. a. Moderate sized (length 13-15 mm); body rather slender; forewing short (about 7 mm long). b. Inner orbits converging below in upper half of face. c. Clypeus about twice (male) or more than twice (female) as wide as long. d. Clypeal apex with median truncation over one third as wide as clypeus, in male produced so that clypeal apex is weakly trilobed. e. Subantennal sutures converging above, longer than (male) or subequal to (female) maximum (lower) width of supraclypeal area. f. Summit of head, seen from front, about horizontal, with ocellar area slightly elevated. g. Ocelli on summit of head, posterior ocellus separated from posterior edge of vertex by



Figures 7-13. Anterior views of labium and inner views of maxilla of Megaloptera. 7, *Ceratomonina rozenorum* n. sp. 8, *Uromonia stagei* n. sp. 9, *Agemmonia tsavoensis* (Strand). 10, *Ceratomonina rozenorum* n. sp. 11, *Uromonia stagei* n. sp. 12, *Agemmonia tsavoensis* (Strand). 13, *Meganomia andersoni* (Meade-Waldo). Scale lines = 0.5 mm; those for labia apply also to maxillae of the same species.

less than an ocellar diameter, distance from anterior edge of anterior ocellus to antennal base nearly twice distance from anterior edge of anterior ocellus to posterior edge of vertex. h. Gena little more than half width of eye seen from side. i. Mandible of male simple, in repose with apex behind clypeal margin, completely hiding labrum. j. Labrum of male about six times as wide as long, with distal depressed part reduced to a mere transverse rim (not produced medially) with a fringe of long bristles; subapical transverse ridge present; surface smooth. k. Labrum of female about ten times as wide as long, distal depressed part absent, but apical fringe of long bristles present, transverse ridge absent or not sharp, whole labral surface convex and punctate. l. Galeal blade short and blunt (Fig. 10). m. Maxillary palpus extending well beyond apex of galea. n. Galeal comb with bristles, except for longer basal ones, of approximately uniform length; preapical notch of galeal blade filled in with transparent material. o. Cardo much shorter than stipes, thickened distally. p. Ligular arm short, reaching neither base nor apex of prementum. q. Glossa and paraglossa about as in *Uromonia*. r. Scape reaching middle (male) or upper margin (female) of median ocellus, in male somewhat thickened (Fig. 58). s. Flagellum of male long, reaching beyond scutellum, segment 1 less than twice as long as apical width, apex deeply concave; segment 2 about as long as broad, segments 3-10 more elongate and progressively narrower so that 10 is about twice as long as broad; segments progressively flatter from 1-11; segments 2-11 with long, erect, simple hairs, curled at tips, on under surfaces, these hairs mostly about as long as length of segments from which they arise, but shorter on 10 and 11; segment 11 broader than rest of antenna, bent downward, discoid. t. Flagellum of female shorter than eye, first segment nearly twice as long as broad, segments 2 to 9 broader than long, 10 but little longer than broad. u. Dorsum of thorax with many short, densely plumose, appressed hairs, almost scale-like in female, among scattered, long, thick, unbranched, erect hairs. v. Upper half of triangular area of propodeum (metapostnotum) less steeply sloping than rest of propodeum in profile. w. Basitibial plate of female well differentiated, with a covering of dense short hairs that terminates sharply at the raised edge of the plate. x. Posterior trochanter of female with ventral margin gently curved. y. Front coxa without posteriorly directed process. z. Fore femur of male swollen with retrorse, posterior basal prominence; middle femur and tibia of male somewhat swollen; male legs otherwise not greatly modified. aa. Inner side of hind tibia of female covered with short spatulate-truncate keirotichia, only at sides with coarse scopal hairs. bb. Scopal hairs coarse, curved, mostly superficially simple but many of them with one to several barbs on convex side. cc. Apex of hind tibia of female without bare area on outer surface. dd. Hind basitarsus of female nearly parallel-sided, second tarsal segment articulated to lower part of apex, upper apical angle prolonged into shiny, flat leaf-like projection similar to that of *Promelitta* (Dasypodinae) but with only one or two hairs on the inner surface. ee. Claws with inner rami truncated lobes. ff. Arolium present; orbicula long and finger-like on middle and hind legs. gg. Prestigma shorter than stigma. hh. Basal vein distad to cu-v and nearly three times as long as first abscissa of Rs. ii. Second and third submarginal cells both narrowed toward anterior (costal) margins, subequal in length on posterior margins, together slightly longer than first submarginal cell.

jj. Marginal cell rather short and broad (Fig. 57). kk. Metasomal terga IV and V with shining, oval, minutely striate, sublateral pregradular ("stridulating") area, behind which the gradulus is arched posteriorly. ll. Seventh tergum of male with weakly bilobed and slightly upturned apex, pygidial plate joining this apex, not produced beyond it, basally extending half way or more across disc of tergum toward gradulus. mm. Metasomal sterna of female without scopa. nn. Metasomal sterna I-V of male with small, shallow median apical emarginations, without conspicuous apical fringes although posterior margins somewhat more hairy than elsewhere, IV and V rather hairy with some of the hairs extending beyond the posterior margins. oo. Sternum V of male otherwise unmodified. pp. Sternum VI of male with broad apical emargination on either side of which is a crescentic area of stiff erect setae, and at apex of lobe lateral to emargination, an area of dense plumose hairs. qq. Sternum VII of male with broad sinus between lateral, apical lobe and body of sternum and area of long, dense, plumose hairs midapically, at bases of lateral apical lobes. rr. Sternum VIII of male without spiculum, with only weak lobes as basolateral apodemes, with rather slender apical process densely hairy below, plate-like above and flattened, with transverse preapical ridge. ss. Gonocoxite of male simple, without special broadened base. tt. Penis valves slender, nearly straight, blunt, not fused dorsally. uu. Volsella relatively large but of the usual form for Meganomia.

Comments. Striking derived characters (autapomorphies) differentiating this genus from the others in the subfamily are i, j, k, l, s, u, ee, and kk (shared with Meganomia). Plesiomorphies which also differentiate this genus from certain others include f, g, w, x, aa, cc, ff, mm, oo, and ss.

There is only a single known species, C. rozenorum, described in Appendix I. It is from Namibia (South West Africa). Some of its behavioral features are indicated by Rozen (1977) under the heading "Meganomia species B."

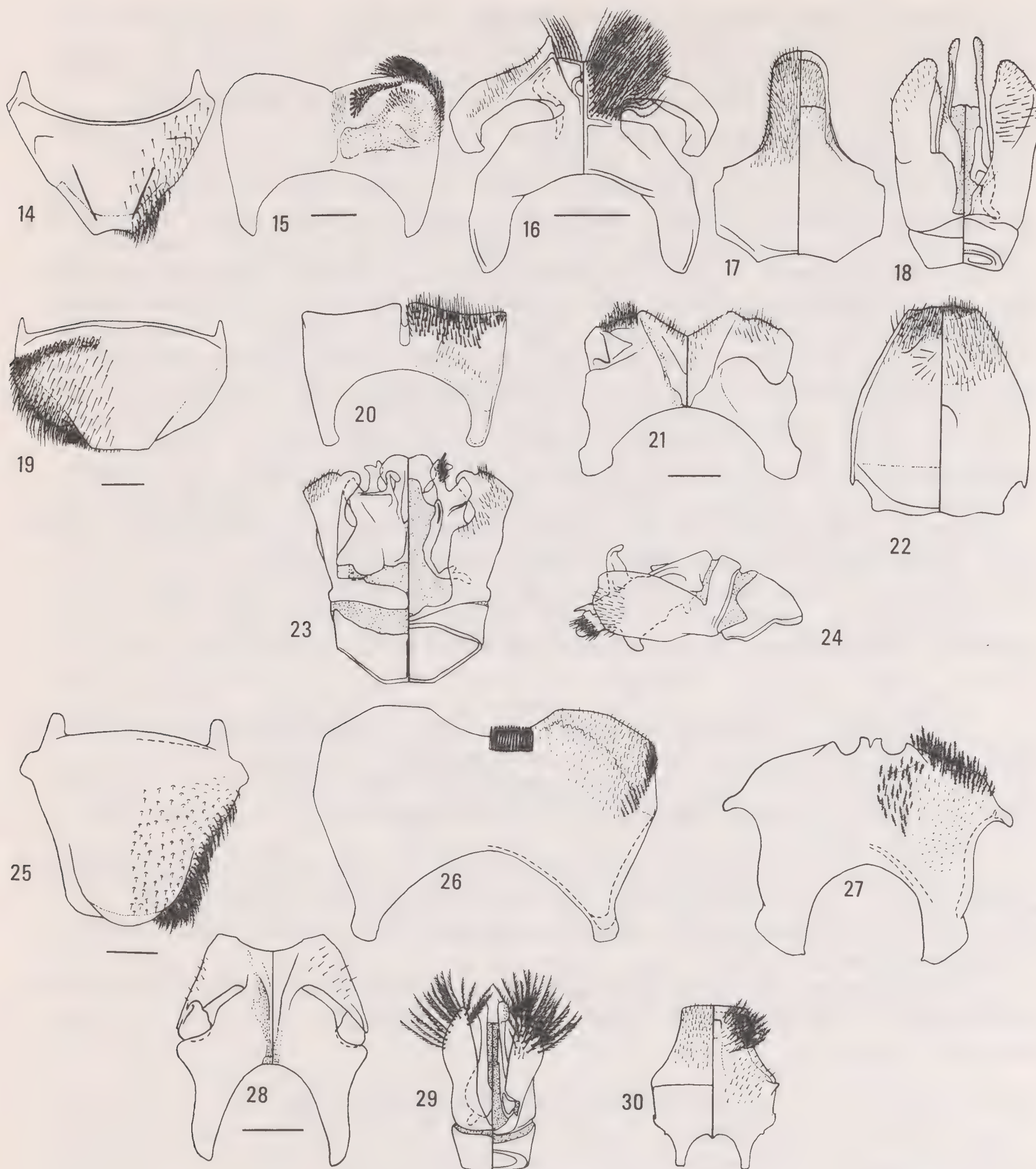
Etymology. Ceratos, horn, with reference to the long and peculiar antennae of the male; and monia, anagram of Nomia.

Uromonia Michener new genus (Figs. 8, 11, 19-24, 53, 57, 58, 197)

Type species: Uromonia stagei new species.

Diagnosis. Male flagellum simple, twelve segmented; basitibial plate of female not defined; labrum over four times as wide as long, apical margin convex or broadly truncate; arolia present; penis valves of males large, complex, with both dorsal and ventral projections.

Description. a. Small but moderately robust, body length 10-12 mm, forewing length 7-8 mm. b. Inner orbits of male distinctly converging below, except diverging at lower extremities; of female parallel except diverging at lower extremities. c. Clypeus about twice (male) or three times (female) as wide as long. d. Clypeal truncation not defined (male) or about half as wide as clypeus (female), no emarginations on clypeal apex that produce a trilobed effect. e. Subanten-



Figures 14-30. Megonomiinae, males. 14-18, *Ceratomonina rozenorum* n. sp. 14, metasomal tergum VII. 15, sternum VI (ventral). 16, sternum VII (dorsal and ventral). 17, sternum VIII (dorsal and ventral). 18, genitalia (dorsal and ventral). 19-24, *Uromonia stagei* n. sp., same sequence of structures plus lateral view of genitalia. 25-30, *Aegemmonia tsavoensis* (Strand). 25, metasomal tergum VII. 26, 27, sternum V and VI (ventral). 28, sternum VII (dorsal and ventral). 29, genitalia (dorsal and ventral). 30, sternum VIII (dorsal and ventral). Scale lines = 0.5 mm; the tergum and sternum V and VI are of one scale, genitalia and sternum VII and VIII at another, for each species.

nal sutures in male diverging above, about three fourths as long as lower width of supraclypeal area; in female subparallel and little over half as long as width of supraclypeal area. f, g, h. Summit of head and genal area as described for Ceratomonía. i. Mandible of male with inner tooth very near apex, in repose only partly hidden behind clypeal margin, labrum not exposed. j. Labrum of male over five times as wide as long; surface smooth, concave; apical margin broadly truncate but no sharp ends of truncation. k. Labrum of female over four times as wide as long, distal depressed part short so that transverse ridge is beyond middle of labrum, area basal to ridge punctate, apical margin of labrum gently convex. l. Galeal blade rather short with fringe of long hairs on posterior margin. m. Maxillary palpus not reaching apex of galea, first segment longer than next two together. n. Galeal comb as described for Meganomia. o. Cardo much shorter than stipes. p. Ligular arms short, ending near middle of prementum, distal third of prementum membranous except for subligular process which arises from weakly sclerotized area on posterior surface of prementum, this area joined by membrane to rest of sclerotized part of prementum. q. Glossa and paraglossa as in Figure 8. r. Scape as described for Ceratomonía. s. Flagellum of male twelve segmented (so that antenna is fourteen segmented), almost reaching front of scutellum, segment 1 1.5 times as long as wide, segment 2 as long as wide, remaining segments a little longer than wide, simple. t. Flagellum of female slightly shorter than eye, ten segmented as in other bees, segment 1 twice as long as broad, 2 broader than long, 3 and succeeding segments about as broad as long, grading to slightly longer than broad apically. u. Dorsum of thorax with hairs of varying lengths, briefly plumose. v. Propodeal profile nearly straight, declivous, especially in female, in male more as described for Ceratomonía. w. Basitibial area of female as in Agemmonia but basal carina on anterior rather than posterior margin. x. Posterior trochanter of female with ventral margin gently curved. y. Front coxa without posteriorly directed process. z. Legs of male simple except swollen apical part of hind tibia. aa. Inner side of hind tibia of female entirely covered with long hairs, keirotrichia absent. bb. Scopal hairs simple. cc. Apical fourth of outer surface of hind tibia of female slightly concave, bare, but with scopal hairs arching over it forming a corbicula-like space. dd. Hind basitarsus of female tapering apically, apex giving rise to second tarsal segment near middle but upper apical angle, just above base of second segment, with sharp, apically directed tooth. ee. Claws of foreleg of both sexes with inner ramus acutely pointed, shorter than outer ramus but similar in shape; claws of mid and hind legs with inner rami truncated lobes. ff. Arolium present; orbicula rather long and finger-like. gg. Prestigma about as long as stigma. hh. Basal vein and cu-v as in Ceratomonía. ii. Second submarginal cell with ends subparallel, or slightly narrowed toward anterior (costal) margin; third strongly narrowed toward costal margin and much longer than second; second and third together slightly shorter than first. jj. Marginal cell as in Ceratomonía. kk. Metasomal terga without "stridular" areas. ll. Seventh tergum of male with broadly truncate pygidial plate extending slightly beyond apex of rest of tergum, basally plate extending less than half way across disc of tergum toward gradulus. mm. Metasomal sterna of female without scopa. nn. Metasomal sterna I-IV but not V of male with small, median, apical emarginations; all these sterna with

rather long preapical hairs but these forming dense fringe only on V, to a lesser degree on IV. oo. Sternum V unmodified. pp. Sternum VI with narrow, almost slitlike median apical emargination and somewhat sclerotized posterior lateral angle which bears a pair of heavy, anteriorly directed pegs, one often larger than the other but sometimes of equal size; distal margin of sternum except laterally with fringe similar to that of V. qq. Sternum VII of male with lateral apical lobe overlapping body of sternum so that no sinus is evident between lobe and body until the parts are manipulated. rr. Sternum VIII without spiculum, with only weak basolateral apodemes, and with broad, flat, truncate apical process which has an only weakly plate-like beveled apex. ss. Gonocoxite of male with abruptly broadened base, expanded and gently lobed apex. tt. Penis valves robust, expanded, grotesquely lobed, with both dorsal and ventral subapical projections, the two valves fused to one another from base to apex, where they project as a flat, median, apical plate. uu. Volsella absent or small and fused to base of penis valve.

Comments. Apomorphous (derived) characters distinguishing this genus include the following: l (fringe on galea), p, s (14-segmented antenna probably unique in the Aculeata), w (shared with Agemmonia), aa, bb, cc, ss, tt, uu. Plesiomorphous characters include the following: b, c, d, f, g, i, s, x, z, ff, kk, nn, oo.

There is only one species, Uromonia stagei, described in Appendix I. It is from the coast of Kenya.

Etymology. Uro, tail (with reference to the large and elaborate male genitalia), and monia, anagram of Nomia, the halictid genus whose name is unfortunately in the root of the generic name Meganomia.

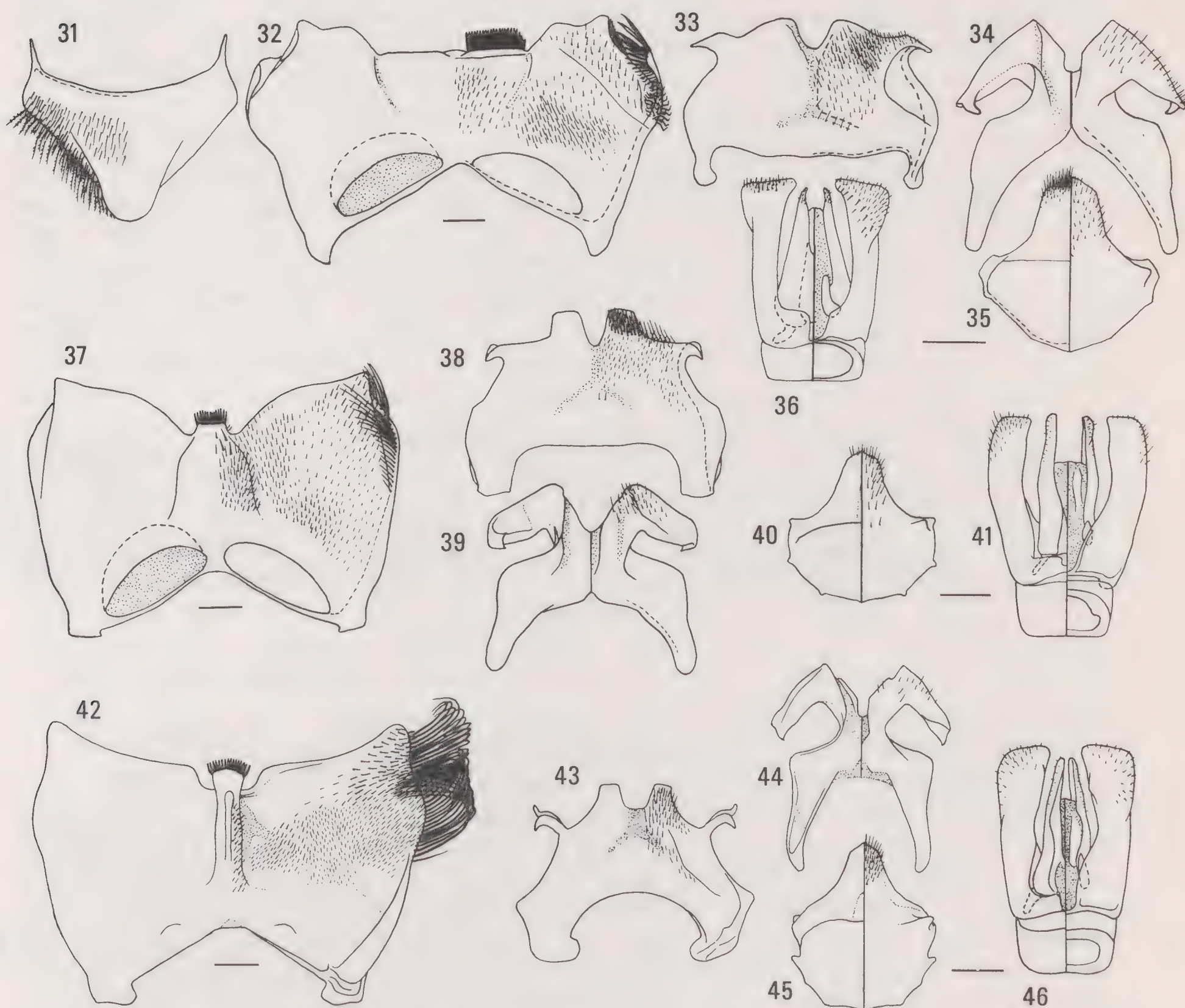
Agemmonia Michener new genus
(Figs. 9, 12, 25-30, 54, 57, 58, 192)

Type species: Nomia tsavoensis Strand, 1920.

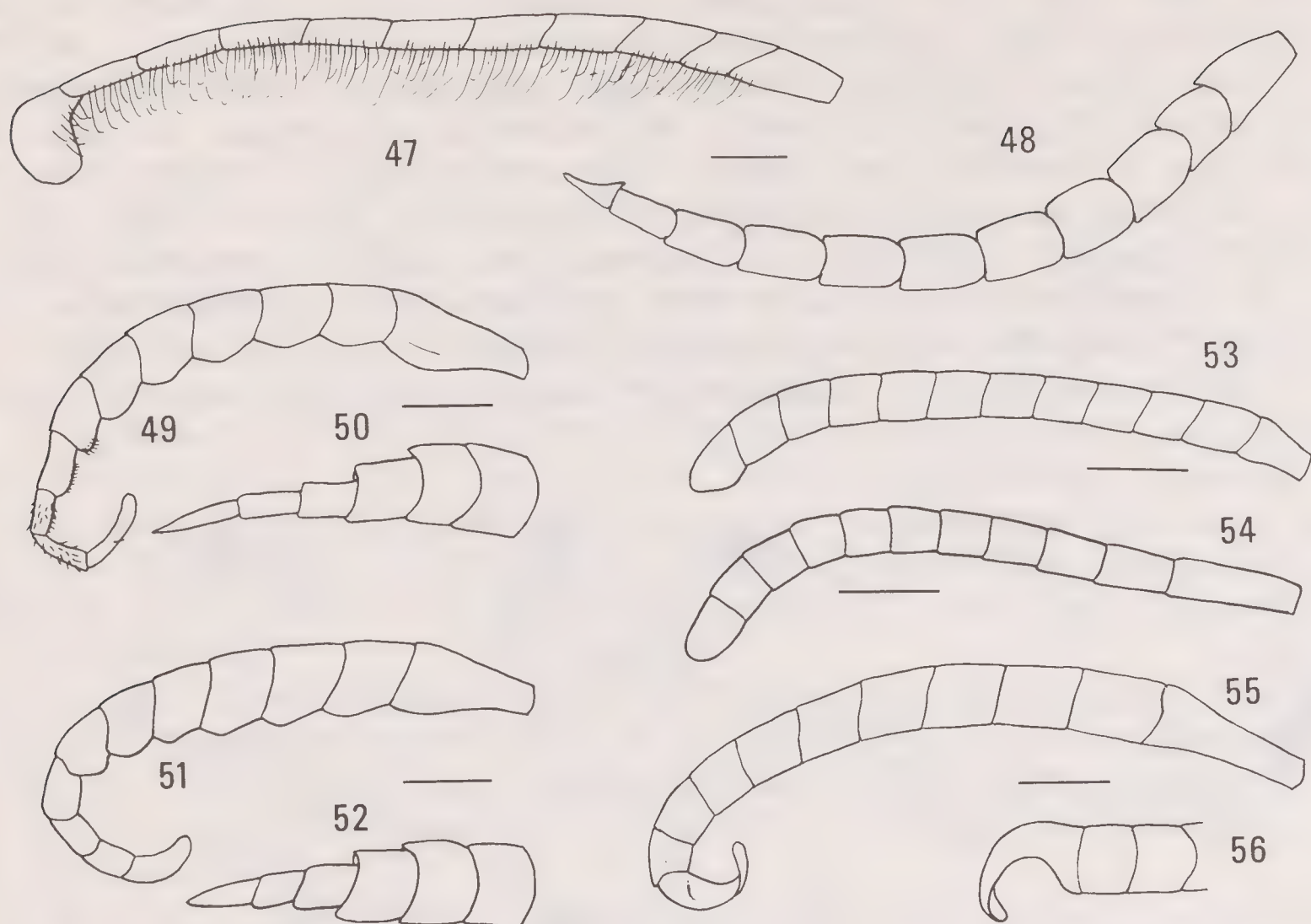
Diagnosis. Male flagellum simple, slender, segments 1-4 all much longer than broad; basitibial plate of female not defined; labrum over three times as wide as long; arolia present. Top of head convex seen from front and ocelli far in front of posterior margin of vertex.

Description. a. Moderate sized (length 13-15 mm); body rather robust; forewing length 11 mm. Longer hairs mostly strongly plumose, those from mandibles, stipes, and hypostomal area forming flat beard on underside of head of male. b. Face broad; inner orbits of male parallel in upper two thirds, diverging below in lower third; of female entirely diverging below. c. Clypeus about three times as wide as long. d. Clypeal truncation of male reduced in width to about distance between antennal sockets, with broad emargination lateral to truncation so that apical margin of clypeus is strongly trilobed; of female about as wide as distance between outer margins of antennal sockets and weakly emarginate lateral to truncation. e. Subantennal sutures parallel or slightly diverging above, half as long as lower width of supraclypeal area. f. Summit of head, seen from front, gently convex. g. Ocelli in front of summit of head; posterior ocellus separated from posterior margin of vertex by three or more ocellar diameters; anterior edge of anterior ocellus about midway between antennal base and posterior edge

of vertex. h. Gena nearly as wide as eye seen from side. i. Mandible of male with weak inner tooth near apex, in repose with apex largely visible from in front, exposing extreme base of labrum. j. Labrum of male about three times as wide as long, with apical depressed part and sharp transverse carina at base; apical margin convex. k. Labrum of female over three times as wide as long, with distal strongly depressed part, rounded apically, and high carinate ridge across base, basal surface of this ridge punctate. l. Galeal blade rather elongate (Fig. 12). m. Maxillary palpus less than half as long as galeal blade. n. Galeal comb reduced to a few slender bristles. o. Cardo a little shorter than stipes. p. Ligular arm long, extending beyond apex of



Figures 31-46. *Meganomia*, males. 31-36, *M. binghami* (Cockerell). 31, sternum VII. 32, 33, sterna V and VI (ventral). 34, 35, sterna VII, VIII (dorsal and ventral). 36, genitalia (dorsal and ventral). 37-41, *M. andersoni* (Meade-Waldo). 37, 38, sterna V and VI (ventral). 39, 40, sterna VII and VIII (dorsal and ventral). 41, genitalia (dorsal and ventral). 42-46, *M. rossi* n. sp., same structures and sequence. Scale lines = 0.5 mm; the tergum and sterna V and VI are at one scale, genitalia and sterna VII and VIII at another, for each species.



Figures 47-56. Flagella of male Megonomiinae. 47, 48, Ceratonomia rozenorum n. sp. (lateral and ventral). 49, 50, Meganomia rossi n. sp. (lateral and straightened ventral). 51, 52, M. andersoni (Meade-Waldo) (same). 53, Uromonia stagei n. sp. 54, Agemmonia tsavoensis (Strand). 55, 56, Meganomia gigas n. sp. (lateral and straightened ventral). Scale lines = 0.5 mm.

prementum, but distal third only weakly sclerotized. q. Glossa attenuate, about as long as prementum. Paraglossa about as in Ceratonomia. r. Scape reaching beyond posterior ocelli, slender. s. Flagellum of male reaching front of scutellum, no thicker than scape, segment 1 about four times as long as broad, nearly half as long as scape; segment 2 twice as long as broad; 3 and 4 longer than broad; 5 slightly so; 6 to 10 about as long as broad; 11 longer than broad. t. Flagellum of female shorter than eye, segment 1 about four times as long as broad, segment 2 slightly longer than broad, 3 about as long as broad, 4 to 9 broader than long, 10 longer than broad. u. Dorsum of thorax with some small, nearly simple hairs among longer, more or less erect, strongly plumose hairs. v. Upper two thirds of triangular area of propodeum sloping strongly but less steeply than posterior surface of propodeum. w. Basitibial plate of female minutely and closely punctate and densely covered by uniform short hairs that grade into those of more distal part of tibia, but plate not delimited by carina except near base on posterior margin. x. Posterior trochanter of female with a preapical ventral tubercle or angle. y. Front coxa without posteriorly directed process. z. Legs of male not swollen or otherwise

highly modified; upper side of hind tibia with two well separated longitudinal carinae between which is a strong concavity. aa. Inner side of hind tibia of female about as described for Meganomia; keirotichia shorter than in that subgenus and the band of such hairs broader. bb. Scopal hairs long, sparse, superficially appearing simple but most with several branches on convex sides near bases. cc. Apex of hind tibia of female without bare area on outer surface. dd. Hind basitarsus as described for Meganomia. ee. Claws of middle and hind legs of female with inner rami truncated lobes, of male and forelegs of female with inner rami acute blades. ff. Arolium present; orbicula long and finger-like. gg. Prestigma as long as or longer than stigma. hh. Basal vein distal to cu-v and over four times as long as first abscissa of Rs. ii. Second submarginal cell with ends parallel; third narrowed toward costal margin. Third submarginal cell longer than second, the two together shorter than first. jj. Marginal cell long, not so slender as in Meganomia s. str. (Fig. 57). kk. Metasomal terga without "stridulatory" areas. ll. Seventh tergum of male truncate with apex of pygidial plate extending slightly beyond truncation; pygidial plate broad, extending basally less than half way across disc of tergum. mm. Metasomal sterna, especially III to VI, of female with long, briefly plumose hairs apparently forming a metasomal scopa. nn. Metasomal sternum I of male with small median apical notch, II-IV without apical emarginations, not fringed. oo. Sternum V of male with broad median emargination across base of which is a comb of stiff bristles, interrupted medially; otherwise not greatly modified. pp. Sternum VI of male as in Figure 27. qq. Sternum VII of male with lateral apical lobe bent back at apex which overlaps body of sternum. rr. Sternum VIII of male with spiculum evident as weak angle; basolateral apodemes strongly projecting anteriorly lateral to spiculum; apical process broad, truncate, without a plate-like apex. ss. Gonocoxite simple, without special broadened base, with long plumose hairs apically. tt. Penis valves slender, nearly straight, broadened and rounded at apices, fused dorsally near bases. uu. Volsella small, almost lost as separate sclerite because of fusion with base of penis valve.

Comments. Apomorphous (derived) characters include the following: a (strongly plumose hairs), b, d, e, f, g, m, n, q, w (shared with Uromonia), x (shared with Meganomia), bb (sparse scopa), gg (shared with Meganomia), mm, oo (comb shared with Meganomia), rr (especially basolateral apodemes), uu. Associated with these are the following plesiomorphous characters which differentiate this genus from certain others: z (little modified legs), ff (arolium), kk, nn, ss (simple base of gonocoxite). None of the plesiomorphous characters distinguishes this from all other genera of Meganomiinae.

This genus contains only two species, Agemmonia tsavoensis (Strand) and A. tavetensis Cockerell, both from arid parts of Kenya. As indicated in Appendix I, it is likely that these forms are not specifically different.

Etymology. Anagram of Meganomia.

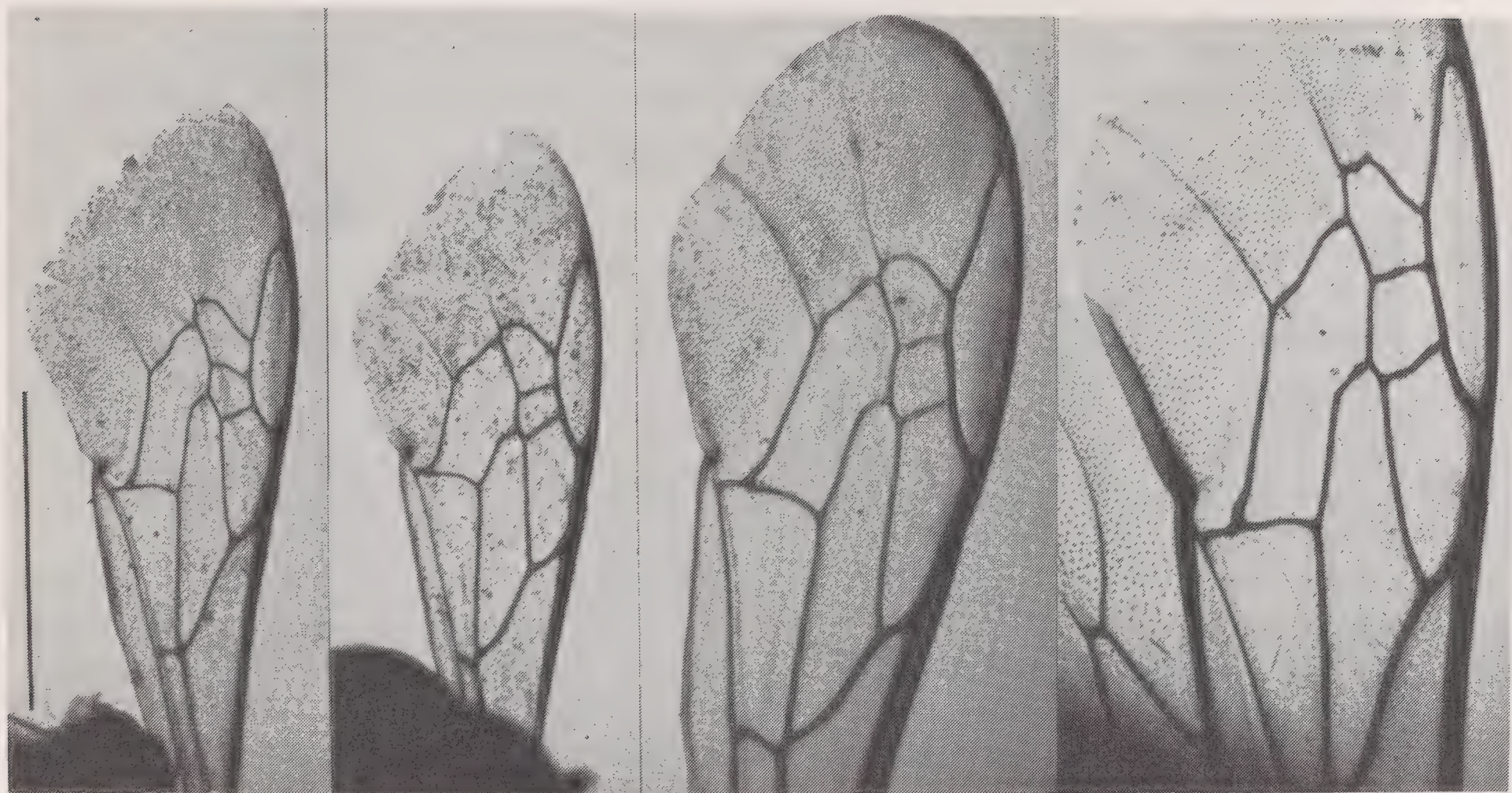


Figure 57. Forewings of Meganomiinae. Left to right, Ceratonomia rozenorum n. sp., Uromonia stagei n. sp., Agemmonia tsavoensis (Strand), and Meganomia gigas n. sp. Scale line = 0.5 mm.

Genus Meganomia Cockerell
(Figs. 13, 31-46, 49-52, 55-59, 193-196)

Nomia (Meganomia) Cockerell, 1909: 402.

Meganomia Cockerell, 1931a, p. 201; Stage, 1971, p. 306; Rozen, 1977, p. 9.

Type species: Nomia (Meganomia) binghami Cockerell, 1909 (monobasic).

Diagnosis. Male flagellum thick, without long hairs beneath, curled apically, the last one to three segments narrowed; basitibial plate of female defined at sides but not apically, hairs on and beyond plate terminating at the same level so that structure of plate is hidden; labrum two to three times as wide as long, apical margin convex or medially emarginate; arolia absent.

Description. a. Large, robust forms (body length 15 to 22 mm); forewing length 10 to 13 mm. b. Inner orbits slightly converging below in upper half of face, below that level diverging, or wholly diverging below in female of M. gigas. c. Clypeal proportions as in Ceratonomia. d. Clypeal truncation about one third as wide as clypeus (rounded in male M. andersoni and rossi), in male distinctly produced so that apex of clypeus is trilobed, in female not or weakly produced. e. Subantennal sutures converging above, slightly longer to slightly shorter than maximum (lower) width of supraclypeal area. f, g. Summit of head and ocellar position as in Ceratonomia. h. Genal area of male about half as wide as eye seen from side, of female well over half eye width. i.



Figure 58. Faces of Meganiinae. Top to bottom, males at left, females at right, Ceratonomia rozenorum n. sp., Uromonia stagei n. sp., Agemmonia tsavoensis (Strand), and Meganomia binghami (Cockerell). Scale line = 0.5 mm.

Mandible of male with inner tooth, in repose only partly hidden behind clypeal margin, extreme base and apex of labrum often exposed. j. Labrum of male 2 to over 2.5 times as wide as long, smooth, convex to emarginate apically, without transverse ridge, not divided into elevated basal and depressed apical portions. k. Labrum of female about 2.5 to 3 times as wide as long with strong transverse median carina, basal to which surface is usually roughened, distal to which it is depressed and smooth. l. Galeal blade moderately long (Fig. 13). m. Maxillary palpus approximately reaching apex of galea. n. Galeal comb with basal bristles curved, much longer than apical bristles (Fig. 13). o. Cardo nearly as long as stipes. p. Ligular arms long, extending from base nearly to apex of prementum. q. Glossa and paraglossa about as in Uromonia. r. Scape reaching ocellar area, in male somewhat broadened, especially near base. s. Flagellum of male rather short (reaching wing base), thick, flattened or crenulate beneath, without long hairs, curled apically, last one to three or four segments attenuated; segment 1 slender basally, more than two to three times as long as broad. t. Flagellum of female about as long as eye, segment 1 slender basally, about three times as long as broad, segments 2 to 9 broader than long to longer than broad (basal ones longer than distal ones which are always broader than long), 10 longer than broad, but sometimes only slightly so, in M. rossi about as long as broad. u. Dorsum of thorax with erect, finely barbed hairs. v. Propodeal profile as in Ceratonomia. w. Basitibial plate of female well differentiated (i.e., elevated) on anterior and posterior margins but apically grading into general tibial surface; dense short hairs that cover plate grading into those of outer tibial surface. x. Posterior trochanter of female with preapical ventral tubercle or angle. y. Front coxa strongly produced posteriorly as a hairy process mesal to base of trochanters (weakly so in male of M. andersoni and M. rossi). z. Middle coxa of male with a smooth protruding process (weak in M. andersoni and M. rossi) below trochanteral base; front and middle femora and tibiae of male not modified; hind femur of male greatly swollen, tibia and basitarsus somewhat modified and contorted. aa. Inner side of hind tibia of female with longitudinal strip of keirotichia with broadened bifid apices, on either side of which scopal hairs occupy broad marginal areas. bb. Scopal hairs coarse, curved (especially those of outer side of tibia), simple (in M. andersoni) to with rather numerous branches on convex sides of more strongly curved hairs (in M. binghami). cc. Apex of hind tibia of female without bare area on outer surface. dd. Hind basitarsus of female gradually tapering toward apex which gives rise to second segment near middle, upper apical angle scarcely prolonged or in M. andersoni and M. rossi prolonged as small, dark, flattened, pointed projection, a miniature of that found in Ceratonomia. ee. Claws of hind legs with inner ramus a truncated lobe (or in male and one female of M. rossi a short, pointed, recurved blade), of other legs with inner ramus an acute blade somewhat shorter than outer ramus but of similar shape. ff. Arolia absent; orbicula short, much exceeded by elongate, hairy planta. gg. Prestigma about as long as stigma. hh. Basal vein slightly distal to, interstitial with, or basal to cu-v and four to six times as long as first abscissa of Rs. ii. Second and third submarginal cells as described for Ceratonomia, or ends of second subparallel. jj. Marginal cell elongate, slender (Fig. 57). kk. Metasomal terga IV and V with specialized "stridulatory" areas as in Ceratonomia. ll.



Figure 59. Faces of *Megalomia*. Top, *M. gigas* n. sp., male, female. Middle, *M. andersoni* (Meade-Waldo), male, female. Bottom, *M. rossi* n. sp.; female, male. Scale line = 0.5 mm.

Seventh tergum of male with well formed, strongly elevated, apically rounded pygidial plate which protrudes beyond rest of tergum and is longer than maximum width of plate; basally marginal carinae of plate extend half way or more across tergum toward gradulus. mm. Metasomal sterna of female without scopa. nn. Metasomal sterna I-IV of male with small, shallow median apical emarginations, larger in M. rossi than in other species; III and IV with dense apical fringes, absent laterally on IV and weak laterally on III in M. rossi. oo. Sternum V of male with broad apical emargination containing one or two combs of stiff, black teeth; lateral margin apically with row of long bristles directed ventrally; base of sternum except in M. rossi with two large, oval, membranous invaginations. pp. Sternum VI of male with narrow apical emargination and strong, lateroapical, laterally projecting process (attenuate, deeply bifid, and projecting posterolaterally in M. rossi). qq. Sternum VII as described for Ceratomonina but without area of long, plumose hairs. rr. Sternum VIII with weak angle representing spiculum, with only weak projections as basolateral apodemes, and with apical process flat, not truncated or plate-like. ss. Gonocoxite of male with abruptly broadened base as seen in dorsal view, apex expanded and truncate. tt. Penis valves slender, nearly straight, rounded apically but laterally compressed and therefore pointed as seen from above, fused dorsally in basal third or half (fusion fully sclerotized in M. andersoni and M. rossi so that penis valves may best be considered as not fused). uu. Volsella as described for Ceratomonina, or in M. andersoni and M. rossi so reduced as to be difficult to recognize.

Comments. Derived characters that differentiate this genus are s, w, x (shared with Agemmonia), z, aa, ff, gg (shared with Agemmonia), kk (shared with Ceratomonina), and oo (combs shared with Agemmonia). No distinctive plesiomorphic generic characters have been recognized; the recognized plesiomorphies of this genus are all shared with one or more other genera of Meganomiinae.

This genus contains Meganomia andersoni (Meade-Waldo), binghami (Cockerell), gigas new species, and rossi new species. All these species are described in Appendix I. The genus occurs from the subtropical parts of South Africa and Namibia to Kenya, in rather xeric localities. Behavior and immature stages of M. gigas are described by Rozen (1977) who used the name M. binghami.

Subfamily Melittinae

Diagnosis. Differs from the other generally non-maculate subfamily (Dasypodinae) in having (a) paraglossa densely hairy, at least nearly as long as its suspensorium; (b) three submarginal cells or if two, then second subequal to or longer than first (true also of some Sambini, only slightly shorter in Promelitta); (c) base of second submarginal cell (first transverse cubital vein) oblique, widely separated from first recurrent vein (true also in some Sambini), and (d) graduli of metasomal terga bent posteriorly at lateral extremities and extending about half way to posterior tergal margin (except in Rediviva and Redivivoides).

Description. a. Body small (7 mm long) to rather large (15 mm long), having the form and often the appearance of an Andrena, without yellow maculations or in Macropis face of male with yellow; supraclypeal

area of female with small yellow spot in Macropis hedini Alfken. b. Mandible of female (and male) with subapical inner tooth (apex of pollex). c. Paraglossa about as long as its suspensorium, not distinctly annulate to rather coarsely annulate (in Dolichochoile), densely hairy. d. Galeal blade without preapical notch or slit on posterior margin. e. Labrum two to six times as broad as long, in some females of Macropis with strong transverse ridge. f. Frontal carina on a strongly convex, sometimes roof-like ridge in the region between antennal bases. g. Malar area linear to as long as broad. h. Clypeus usually without longitudinal median ridge. i. Propodeal triangle variable. j. Forewing with two or three submarginal cells, second (if there are two) or second plus third about as long as or slightly longer than first, second (if there are two) or third strongly narrowed toward costal margin, second (if there are three) parallel-sided or narrowed toward costal margin. Base of second submarginal cell slanting, not at right angles to the longitudinal veins, well separated from first recurrent vein. k. Basal vein 1.3 to 3 times as long as first abscissa of Rs, variable in position relative to vein cu-v. l. Stigma less slender than in Meganomiinae, prestigma over one third to nearly two thirds as long as stigma; vein r arising near middle of stigma; sides of stigma basal to vein r converging slightly toward base of stigma. m. Apex of marginal cell narrowly rounded or pointed, bent away from costal margin only to extent of one or two vein widths. n. Jugal lobe of hind wing one third to over one half length of vannal lobe. o. Mid and hind basitarsi narrower than tibiae or in some females hind basitarsus fully as wide as tibiae. p. Hind basitarsus of female parallel-sided or usually tapering distally, apex giving rise to segment 2 at lower margin, apex of basitarsus above base of segment 2 extending slightly distally. q. Metasomal terga usually with apical bands of pale hair arising from depressed apical marginal zones, these bands sometimes only feebly represented at sides (e.g., in Melitta haemorrhoidalis Fabricius), or sometimes expanded to cover much of terga (e.g., in some Sinomacropis); prepygidial and pygidial fimbriae strong. r. Metasomal terga I to IV of females and I to V of males with rather broad usually depressed apical zones, impunctate or more finely or sparsely punctate than rest of exposed tergal surfaces, these zones sometimes not differentiated except laterally. s. Lateral extremities of graduli of terga II to IV of females, II to V of males bent posteriorly, then fading away, not continuing over half way from bends to posterior tergal margins, in Rediviva and Redivivoides scarcely continuing posteriorly. t. Pygidial plate of male present or absent. u. Sternum VII of male a plate often with modified apical margin and with greatly reduced lateral apical lobes or disc reduced but with paired apical processes or lateral apical lobes or both. v. Sternum VIII of male usually with heavily sclerotized apical process, with or without apical bevelled plate. w. Volsella well developed. x. Gonostylus variable.

Comments. The bees here included in the Melittinae have been divided in some previous classifications (Michener, 1944) into the Melittinae and Macropidinae. Separation at the subfamily level seems unnecessary; recognition of two tribes, Melittini and Macropidini, would be a possibility since Macropis is rather distinctive. If the cladogram shown in Figure 1 is correct, recognition of tribes seems quite undesirable while if that shown in Figure 2 is correct, such recognition seems more appropriate. (For further comments, see below and the sec-

tion on Cladograms.)

The Melittinae has no known synapomorphies (Fig. 2) or only one, shared with the Dasypodinae (Fig. 1). Thus it is probably a paraphyletic group from which the Dasypodinae and possibly also the Meganomiinae arose. The decision to unite the Macropidinae with the Melittinae is based especially on similarities between Macropis and Rediviva (an obvious relative of Melitta). As indicated in Figure 1 and the discussion of cladograms, both have the hind tibia and basitarsus of the female broad, the latter short, the scopa on each with a plumose understory and emergent simple bristles, the basitarsus with the hairs of the apex parted to show a narrow apical hairless line. Both also have the front and sometimes the middle tarsi thickened and covered with velvety or spatulate hairs. These are synapomorphies not found in any related bees and are relatively complex, hence perhaps not evolved independently in Macropis and Rediviva. If it could be shown that this complex of features was secondarily lost in the Melittinae that lack them, they would constitute important evidence of the monophyly of the Melittinae. Figure 2 suggests another alternative, namely that they arose independently (convergently) in Macropis and Rediviva as adaptations to oil collecting.

The similarity of Macropis and Melitta in larval characters is emphasized by Rozen and McGinley (1974). There is nothing in their study that justifies tribal or subfamilial separation of these genera.

The Melittinae as here understood exhibit several plesiomorphies which unite them. Among these are the slanting base of the second submarginal cell (instead of transverse, a feature of most Dasypodinae), and especially the fact that the larvae spin cocoons and have all the necessary labial equipment to do so (lacking in Dasypodinae whose larvae are known). These features are shared with the Meganomiinae, and appear to be primitive melittid attributes.

The Melittinae is found in the Holarctic Region and in Africa. It is absent elsewhere.

Key to the Genera of Melittinae

1. Two submarginal cells; pygidial plate of male present; male with yellow face marks; gonostylus of male long, slender at base, articulated to gonocoxite; eighth metasomal sternum of male not ending in bevelled area suggestive of a pygidial plate (Holarctic Region).
-----Macropis
- Three submarginal cells; pygidial plate of male absent; yellow face marks absent; gonostylus of male broadly fused to gonocoxite; eighth metasomal sternum of male ending in a bevelled area suggestive of a pygidial plate.
-----2
2. Propodeal triangle dull (finely granular), large (width at upper margin usually at least nearly equal to distance between transmetanotal sutures); second submarginal cell wider than long or about as long as wide; seventh metasomal sternum of male a large plate, truncate or emarginate apically, the lobes or processes

reduced to small sclerotic structures and sometimes hair patches at posterior lateral angles of sternum (Holarctic Region and Africa).
-----3

- Propodeal triangle shiny (usually smooth), often ill defined, small (width at upper margin not over half distance between trans-metanotal sutures and often much less); second submarginal cell usually longer than wide; seventh metasomal sternum with disc small, apex bifid or with membranous lobes or both (Africa).
-----4

- 3. Maxillary palpi reduced to two short, fused segments; mandible of female slightly longer than eye, distal half a long, flat, pointed blade, at base of which on inner side are two small teeth; surface of labrum rather uniformly convex, impunctate except near apical margin (Eastern North America).
-----Dolichochoile

- Maxillary palpi six-segmented; mandible of female shorter than eye, of ordinary form with one subapical inner tooth; labrum with wedge-shaped, slightly depressed, median punctate area partially dividing smooth area (Holarctic Region and Africa).
-----Melitta

- 4. Scopa of female consisting of simple bristles; hind tibia and basitarsus of female slender, the latter three or more times as long as wide; anterior tarsus ordinary, with ordinary vestiture; seventh metasomal sternum of male with apex weakly emarginate, at each side of apex a large, flat, vertically expanded process with long erect hairs on outer surface.
-----Redivivoides

- Scopa of female with densely plumose understory beneath long simple bristles; hind tibia and basitarsus of female broad, the latter about twice as long as broad; anterior tarsus thickened or elongated, with dense, short vestiture; seventh metasomal sternum of male with apex deeply bifid or with two long, slender apical processes, at each side lobes, if present, hairless (although spiculate), not flattened, but coarsely striate or ribbed.
-----Rediviva

Genus Melitta Kirby
(Figs. 60-65, 70-76)

Melitta Kirby, 1802, p. 117.

Type species: Melitta trincincta Kirby, 1802, by designation of Richards, 1935, p. 172.

Cilissa Leach, 1815, p. 155.

Type species: Andrena haemorrhoidalis Fabricius, 1775, by designation of Westwood, 1840, p. 84.

Kirbya Lepeletier, 1841, p. 145 (preoccupied).

Type species: Melitta tricineta Kirby, 1802, by designation of Sandhouse, 1943, p. 561.

Pseudocilissa Radoszkowski, 1891, p. 241.

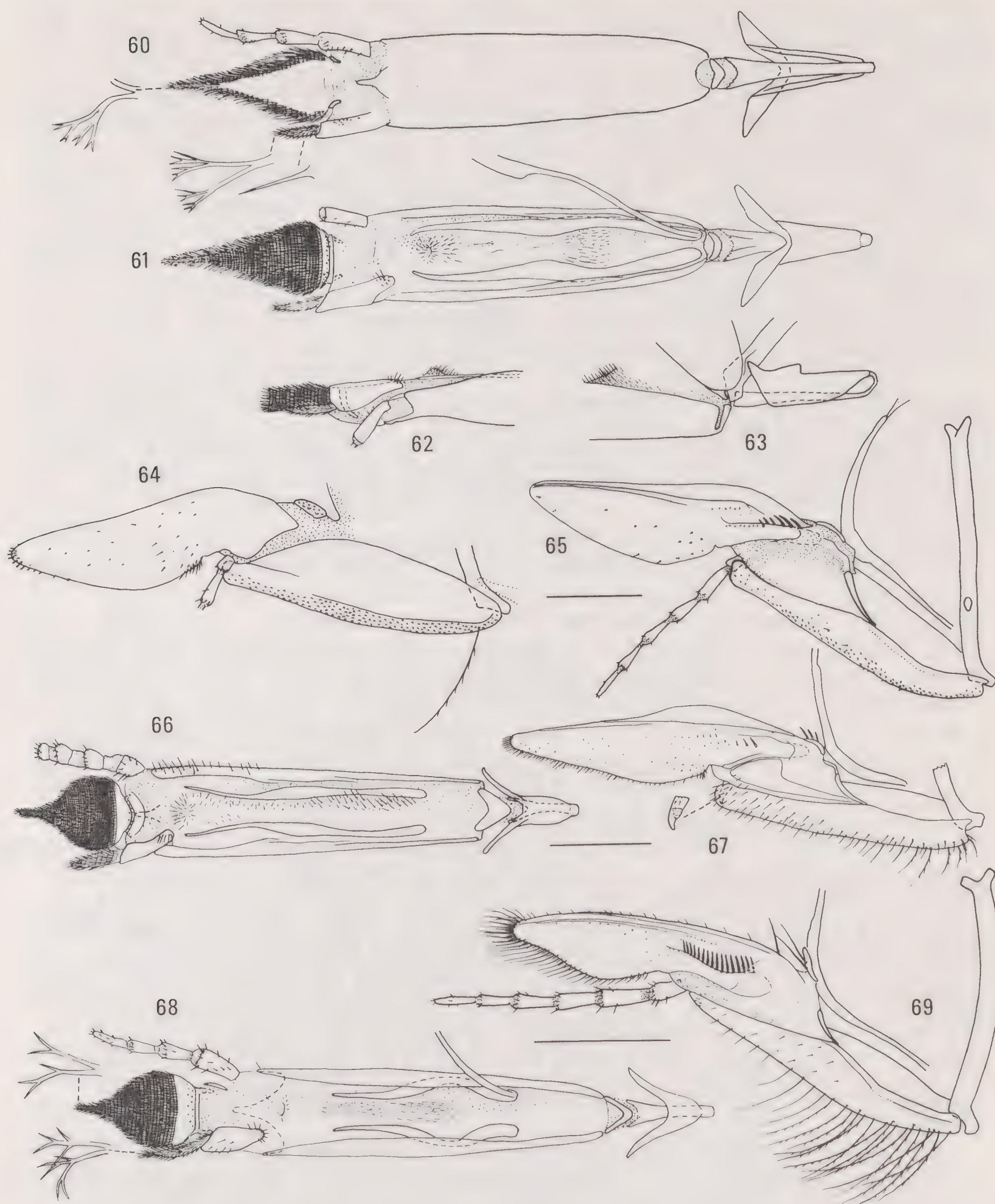
Type species: Cilissa robusta Radoszkowski, 1876 (= Melitta dimidiata Morawitz, 1876), monobasic.

Brachycephalapis Viereck, 1909, p. 47.

Type species: Melitta (Brachycephalapis) californica Viereck, 1909, by original designation and monobasic.

Diagnosis. Melittine bees with three submarginal cells; mouthparts ordinary for the group; scopa on outer sides of hind tibia and basitarsus of female simple, these segments slender; propodeal triangle large, dull; seventh metasomal sternum of male with large disc and insignificant lateral apical lobes.

Description. a. Face black. b. Blade of galea with or without long marginal hairs, often intermediate with rather short hairs; galeal comb short, with less than eight bristles, often only two or three large ones. c. Ligular arm of labium long, base near base of prementum or sometimes separated from latter by about width of prementum, distal part of ligular arm sometimes weakly sclerotized. Labial palpus of ordinary elongate form. d. Labrum not much if any over three times as wide as long, not much narrowed laterally, with lateral apical lobe so that apical labral margin is often concave. Mandible of ordinary form with preapical tooth. e. Surface of labrum with impunctate, slightly elevated basal area partially divided medially by triangular, wedge-shaped, slightly depressed punctate area which is broad apically and pointed basally. f. Malar space linear to as long as broad. g. Propodeal triangle dull, granular or minutely rugose; large, extending at least half way from anterior propodeal margin to metasomal attachment and width at upper margin at least nearly equal to distance between transmetanotal sutures, upper margin only slightly less steeply inclined than the rest. (In M. nigricans Aflken triangle markedly narrower than distance between transmetanotal sutures.) h. Forewing with three submarginal cells [rarely two as individual variant (Sakagami, 1976)]. i. Stigma slightly more slender than in Macropis, so that length from base to base of vein r is at least twice greatest width (scarcely so in M. dimidiata Morawitz). j. Second submarginal cell wider than long or about as long as wide [e.g., in M. americana (Smith)]. k. Basal vein of forewing less than twice length of first abscissa of Rs and distal to cu-v or interstitial with it. l. Jugal lobe of posterior wing slightly less than to slightly more than half length of vannal lobe. m. Hind tibia and basitarsus of female slender, basitarsus three or more times as long as broad, ending in small process above base of second tarsal segment. n. Tibial and basitarsal scopa (on outer sides of these segments) consisting of simple bristles, sometimes marginal ones branched. o. Hairs of apex of hind basitarsus of female not parted, the apical process being merely hairy. p. Hind basitarsus of male slender, without comb; apex not conspicuously truncate, without projection below base of second segment. q. Fore and mid tarsi of female not



Figures 60-69. Mouthparts of Melittinae. 60, 61, Posterior and anterior views of labium of *Melitta leporina* (Panzer). 62, 63, Lateral views of portions of labium of same, positioned relative to Figure 61, anterior surface upward. 64, 65, Outer and inner views of maxilla of same. 66, 67, Anterior view of labium and inner view of maxilla of *Dolichochoile melittoides* Viereck. 68, 69, Same, of *Macropis europaea* Warncke. Scale lines = 0.5 mm; the scale is the same for all figures of any one species.

thickened, without dense, velvety hairs; small segments somewhat more robust than those of hind tarsi. r. Pygidial plate of male absent. s. Seventh metasomal sternum of male with disc or body of sternum large, almost as in preceding sterna; apex broadly truncate or medially emarginate; apical lobes reduced to small sclerotic structures and sometimes hair patches at posterior lateral angles of sternum. t. Eighth metasomal sternum of male with apical process ending in a well defined bevelled area, broader than long or as broad as long, suggestive of a pygidial plate; base of eighth sternum a rounded or pointed spiculum. u. Gonostylus robust, rather broadly fused to gonocoxite. v. Volsella with digitis extending much farther posteriorly than cuspis as a parallel-sided or capitate, blunt process, usually with teeth along outer margin but these not opposable to cuspis.

Comments. Melitta is probably near the ancestral melittine group. The other genera of the subfamily may have arisen from forms that would be placed near Melitta if they were extant. Character s is a synapomorphy of Melitta (shared with Dolichochile), if the small bodied seventh sternum of the male with lateroapical lobes (found in most colletids panurgines, dufoureae, ctenoplectrids, fideliids, and some anthophorines, as well as in Meganomiinae and other Melittinae) is the ancestral state. While this seems likely, a broad seventh sternal plate is characteristic of sphecoid wasps and it is possible that that of Melitta is a plesiomorphy derived from wasp ancestors. Character v is more clearly a synapomorphy of Melitta (with Dolichochile), the opposed or more nearly opposed digitus and cuspis of all other Melittinae being plesiomorphic relative to the condition in Melitta. The opposed digitus and cuspis is characteristic of most Hymenoptera from Symphyta to the short-tongued bees. The reduced galeal comb (part of character b) is unusual among related groups of bees and is a probable synapomorphy.

The genus Melitta appears to be most abundant and diverse in the Palearctic Region, within which it ranges from England, Morocco, and the Canary Islands to Japan. It occurs also in the Nearctic Region, with only two species, M. americana Smith in the eastern states, and M. californica Viereck, in the desert of southernmost California and Baja California. Otherwise the genus is found only in Africa, where M. capensis Friese (first described as a variety of the Palearctic M. dimidiata Morawitz), M. albida Cockerell and others are found in the arid southern part of the continent. Probably the African species listed by Cockerell (1935) fall in this genus as currently interpreted. I have not seen material of this genus from the equatorial parts of Africa.

The genus seems moderately diverse but I see no need to subdivide it, as have Radoszkowski (1891) and Baker (1965). Both of these authors have placed Melitta dimidiata Morawitz in a separate genus, Pseudocilissa. The distinctive features of M. dimidiata Morawitz include its large size, long bristles on the lacinia and adjacent basal galeal margin, the dense long hairs on the under surface of the apical process of sternum VIII of the male (approached in M. capensis), the robust and complex penis valve with a strong lateral projection, and the shape of sternum VII of the male which is broadest apically instead of basally. Such features do not seem to justify generic recognition for a single species, especially since various other species exhibit almost equally unusual features. Thus M. capensis Friese (= longicornis Friese) has two apical processes on the gonostylus, one ventral and recurved, one

lateral and straight, and basal to these processes a large ventral pocket from which project long plumose hairs. The fringe of the galeal blade in this species consists of short hairs only. In the similarly large M. californica Viereck the apex of the gonostylus is attenuate and down-curved, and the galeal blade almost lacks a fringe. Among smaller species, M. nigricans Alfken is unusual in the rather small propodeal triangle. M. haemorrhoidalis (Fabricius) has an unusually sclerotized and sharply pointed galeal blade without a fringe. As indicated in the description above, the malar area is variable. Usually it is short, nearly linear, often longer above the posterior mandibular articulation than above the anterior one. However, in M. capensis Friese from South Africa and the otherwise unrelated M. caroli (Cameron) (described as an Andrena) and M. altissima Cockerell from the Himalayan Region, the malar area is about as long as broad.

Warncke (1973) divided the west-Palearctic species into two subgenera, Melitta and Cilissa, but gave no characters or reasons for this arrangement. He failed to mention the name Pseudocilissa but included its type species in Cilissa. Wu (1978) has reviewed the numerous Chinese species.

Papers on the nesting biology of Melitta include Malyshev (1923) and Tirgari (1968).

Genus Dolichochile Viereck (Figs. 66, 67, 77-79, 97)

Dolichochile Viereck, 1909, p. 49.

Type species: Dolichochile melittoides Viereck, 1909.

Diagnosis. As in Melitta, differing most conspicuously by characters of mouthparts underlined below.

Description. Agrees with the description of Melitta except as follows: b. Blade of maxilla with short fringe of rather short hairs (as in some Melitta); maxillary palpus reduced to two fused segments, total length less than half of maximum width of galeal blade; galeal comb reduced to two bristles and a small third, these arising well behind the fold on which well developed combs usually arise. c. Base of ligular arm separated from base of prementum by about width of latter (as in some Melitta). Labial palpus short and robust, fourth segment and sclerotized parts of second and third broader than long. d. Mandible of female slightly longer than eye, rutellum enormously extended as broad, curved, flat blade about as long as rest of mandible; apex of pollex bilobed so that there are two small teeth on inner mandibular margin about half way from base to apex. e. Surface of labrum rather uniformly convex, impunctate except near apical margin. f. Malar space nearly as long as broad (as in some Melitta). j. Second submarginal cell about as long as wide (as in some Melitta).

Comments. This genus consists of a single species found in the Atlantic Coast states of North America. It is plainly a specialized derivative of Melitta, probably of the group of Melitta americana (Smith) with which it shares many characters. Recognition of Dolichochile at any taxonomic level (genus or subgenus) makes the equivalent taxon Melitta (genus or subgenus) paraphyletic. I do not reject paraphyletic taxa merely because they are paraphyletic. In this

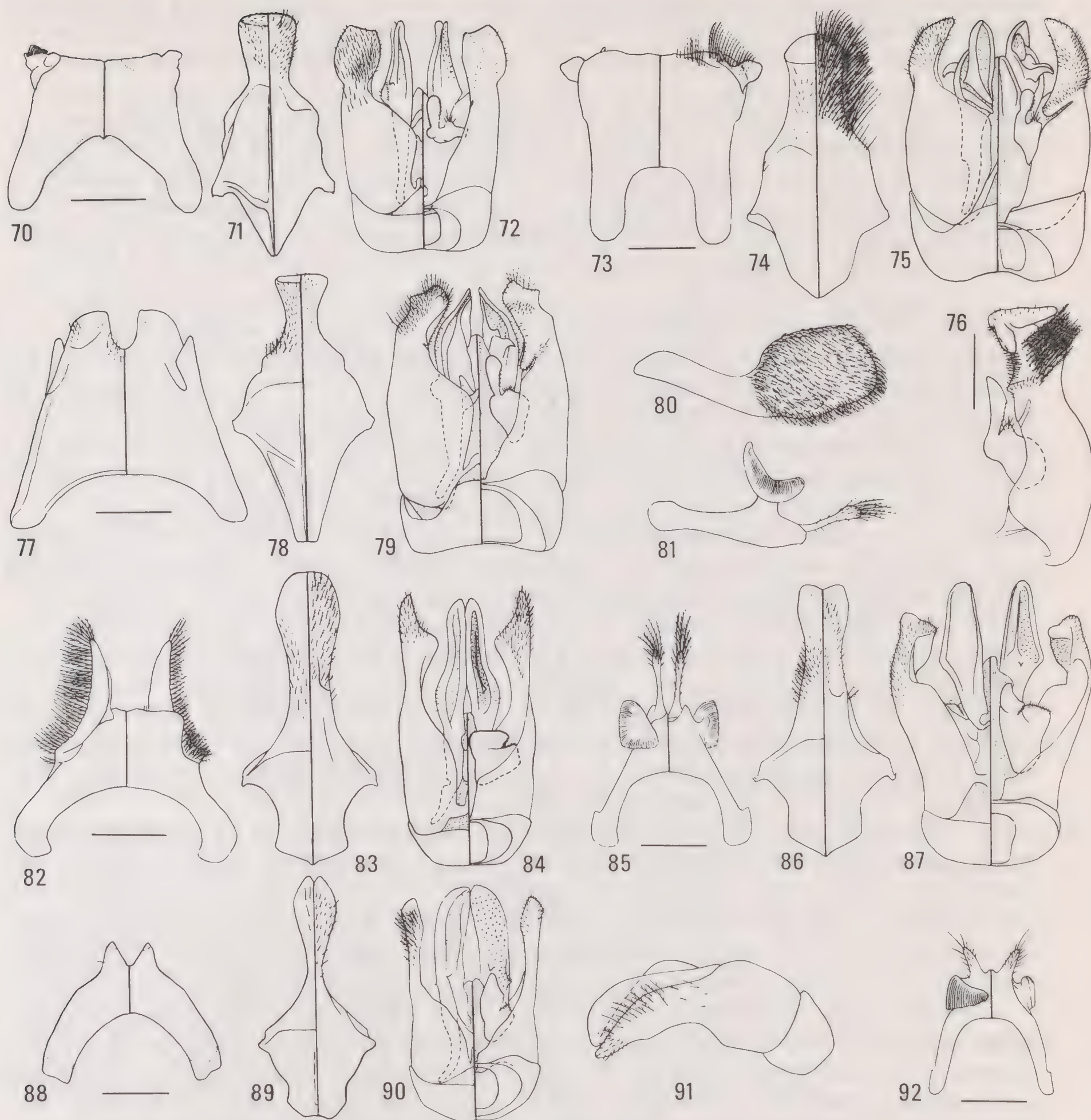
case I believe recognition of Dolichochile as a genus or subgenus is justified by the extraordinary characters listed above under b, c, and d. The short palpi are unlike those of any other melittid. Other melittids except perhaps Paramacropis have six-segmented maxillary palpi; in Dolichochile they are two-segmented, and much shortened, so that the two segments together are little if any longer than the first segment in other melittids. The proboscis as a whole seems somewhat reduced, as indicated not only by the greatly reduced palpi, but also by the small mentum and lorum, greatly reduced galeal comb, and the like. The coarsely annulate paraglossae are another unusual feature; more species of Melitta should be examined to determine the constancy of lack of annuli as a character in that genus. The long, blade-like mandibles of the female are unlike those of any other bee. The labrum (character e) is similar to that of Rediviva; it is likely that this resemblance is a result of convergence.

Redivivoides Michener new genus
(Figs. 80, 82-84, 97)

Type species: Redivivoides simulans new species.

Diagnosis. Melittine bees with three submarginal cells; mouthparts ordinary for the group; front and middle tarsi of female as in Melitta, not thickened or densely hairy as in Rediviva; scopa on outer sides of hind tibia and basitarsus of female short and simple, these segments slender; propodeal triangle small, ill-defined, shining; seventh metasomal sternum of male with reduced disc, non-bifid apex, large and vertically expanded, hairy, membranous lobe on either side of apex; seventh metasomal tergum of male with weak pygidial plate.

Description. Agrees with description of Melitta except as follows:
b. Blade of maxilla with fringe of long hairs; galeal comb long, consisting of over 15 bristles. c. Ligular arm of labium short, base separated from base of prementum by more than width of prementum, apex not extending into distal third of prementum, thus even more abbreviated distally than in Macropis. d. Labrum narrowed and rounded laterally, without lateral apical lobe, apical margin therefore convex. e. Surface of labrum largely smooth, convex, without median, wedge-shaped, depressed, punctate area. f. Malar space between one third and one fourth as long as wide. g. Propodeal triangle shining, poorly defined, small, not extending half way from anterior propodeal margin to metasomal attachment and width about one third of distance between transmetanotal sutures. j. Second submarginal cell a little longer than wide. k. Basal vein of forewing over twice as long as first abscissa of Rs, slightly to distinctly basal to cu-v. l. Jugal lobe of posterior wing about two fifths as long as vannal lobe. m. Hind tibia and basitarsus of female slender, basitarsus about or slightly more than three times as long as broad, apex rounded above and projecting slightly beyond base of second segment. n. Tibial and tarsal scopa (on outer side of these segments) consisting of rather short, simple bristles. (Anterior margin of hind tibia of female shining with only scattered long hairs arising from it, thus unlike other genera.) r. Seventh



Figures 70-92. Melittinae, males. 70-72, Metasomal sterna VII and VIII and genitalia (dorsal and ventral), *Melitta tricineta* Kirby. 73-75, Same structures and sequence, *M. dimidiata* Morawitz. 76, Ventral view of gonoforceps, *M. capensis* Friese. 77-79, Sterna VII and VIII and genitalia (dorsal and ventral), *Dolichochoile melittoides* Viereck. 80, 81, Lateral views, sternum VII, *Redivivoides simulans* n. sp. and *Rediviva peringueyi* (Friese). 82-84, Sterna VII and VIII and genitalia (dorsal and ventral), *Redivivoides simulans* n. sp. 85-87, Same structures and sequence, *Rediviva peringueyi* (Friese). 88-90, Same structures and sequence, *R. colorata* n. sp. 91, Lateral view of genitalia of same. 92, Sternum VII (dorsal and ventral), *R. rufocincta* (Cockerell). Scale lines = 0.5 mm; the scale is the same for all figures of any one species.

metasomal tergum with slightly elevated, bare pygidial plate, obtusely angulate posteriorly, much broader than long. s. Seventh metasomal sternum of male with disc or body rather small; apex slightly emarginate, each side with a large, rounded, vertically expanded process which is concave and covered with long, erect hairs on lateral surface, this lobe not striate. t. Eighth metasomal sternum of male with apical process ending in a bevelled area which is longer than broad and not defined basally, apex not notched. u. Gonostylus slender basally but fused to gonocoxite. v. Volsella with digitis directed laterally, not posteriorly as in Melitta.

Comments. This genus is closely related to Rediviva and could represent the ancestral stock from which that genus arose. Compared to Rediviva it possesses a series of presumably plesiomorphic characters that suggest Melitta. These are characters m, n, o, q, and the lack of a deeply bifid apex of the seventh sternum of the male (part of s). In most other features Redivivoides is like Rediviva. The front legs of the female (character q) are like those of Rediviva rufocincta (Cockerell) (Fig. 93) except that the small segments of the tarsus are slender, sparsely haired. Characters m, n, o, and q as they occur in Rediviva and Macropis are presumably related to oil collecting. The alternatives found in Redivivoides suggest that this genus is not an oil collecting bee. For bees and melittids as a whole, oil collecting is apomorphic—hence the presumption that these characters are synapomorphous for Macropis and Rediviva and plesiomorphous for Redivivoides. Another interpretation is possible, however, i.e., that oil collecting and oil collecting structures have been lost in Redivivoides, as they appear to have been in some groups of Centris (Anthophoridae) (J. Neff and B. Simpson, personal communication).

The presence of a weak pygidial plate (character r) differentiates this genus from both Melitta and Rediviva. It must be plesiomorphic for bees, but see discussion under Macropis. The form of the volsella (character v) is also plesiomorphic for bees, with Rediviva and Melitta both apomorphic. Such characters suggest that Redivivoides may be a member of a group from which both Rediviva and Melitta are derived.

The large, vertically flattened (i.e., laterally compressed), hairy lateroapical lobes of sternum VII of the male probably constitute an apomorphy for Redivivoides. Such lobes are less developed or even absent in Rediviva and are hairless, ribbed, and spiculate, not vertically flattened; I know of no other bees in which they are shaped and positioned as in Redivivoides.

Redivivoides is known only from western Cape Province, South Africa. I have seen three species, two of them represented by only one or two female specimens in the collections known to me; the third, fortunately, was collected in good numbers and is named in Appendix I.

Etymology. Rediviva, a related melittid genus, plus -oides, resembling.

Genus Rediviva Friese (Figs. 81, 85-97)

Rediviva Friese, 1911, p. 671.

Type species: Andrena (Rediviva) peringueyi Friese, 1911, by designation of Cockerell, 1931b, p. 402.

Notomelitta Cockerell, 1933b, p. 128 (new synonym).

Type species: Rediviva neliana Cockerell, 1931b, by original designation and monobasic.

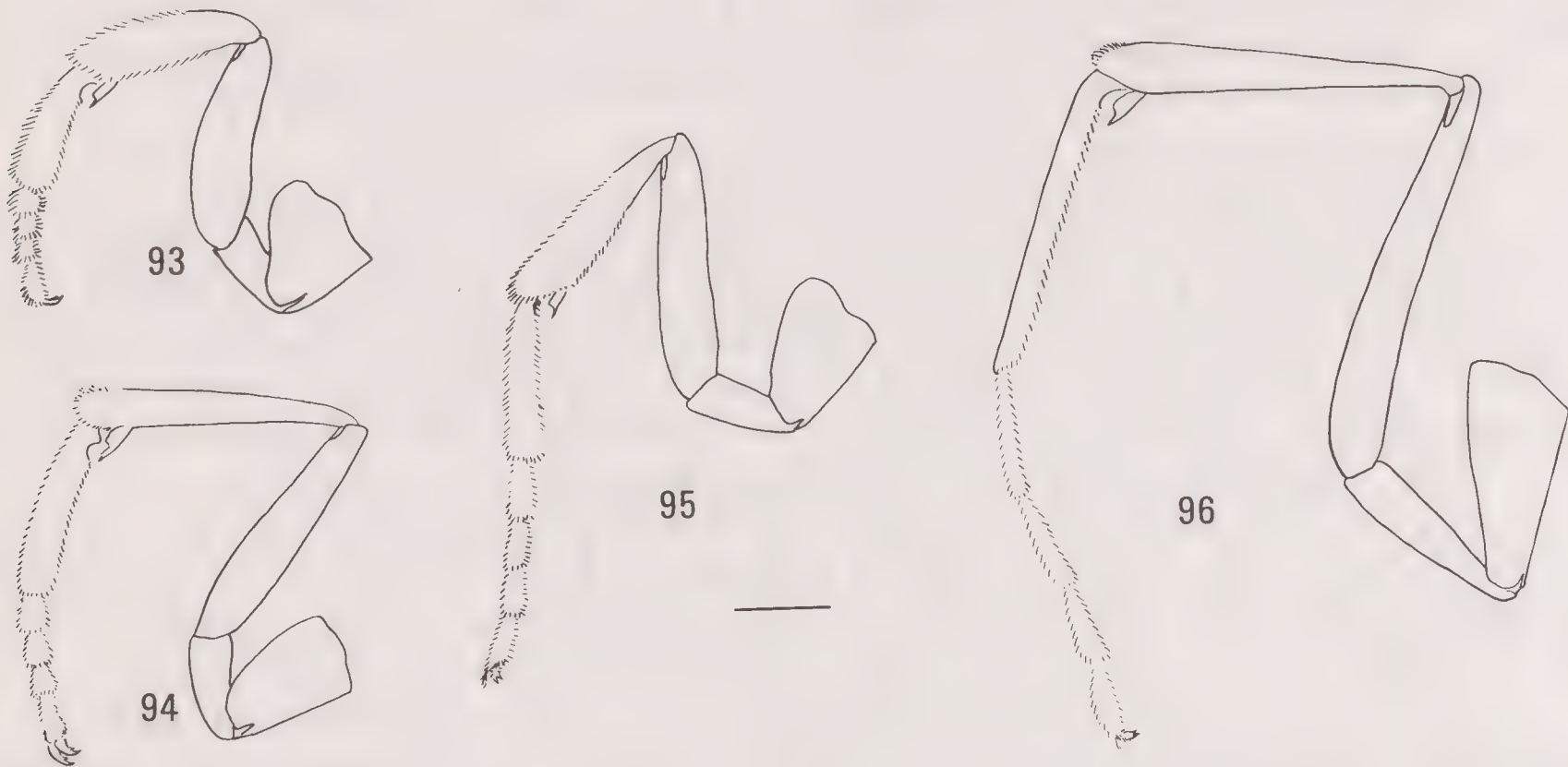
Diagnosis. Melittine bees with three submarginal cells; mouthparts ordinary for the group; anterior tarsus of female thickened, often also elongate, with short, dense vestiture; scopa on outer sides of hind tibia and basitarsus of female densely plumose, hiding surface, with long, simple emergent hairs; propodeal triangle small, shining; seventh metasomal sternum of male with reduced disc and usually with lateroapical lobes, apex deeply bifid.

Description. Agrees with description of Melitta except as follows: b. Galeal blade with moderately long marginal hairs. c. Ligular arm of labium short, base variable but apex not extending into distal third of prementum, thus even more abbreviated distally than in Macropis. d. Labrum narrowed and rounded laterally, without lateral apical lobe, apical margin therefore convex. e. Surface of labrum largely smooth [or in R. rufocincta (Cockerell) distal two thirds punctate], convex, without median, wedge-shaped, depressed, punctate area. g. Propodeal triangle shining, usually poorly defined, minute to small, often not extending half way from anterior propodeal margin to metasomal attachment and width not over half distance between transmetanotal sutures, often much less. j. Second submarginal cell usually longer than wide, in R. colorata new species about as wide as long. k. Basal vein of forewing usually twice as long as first abscissa of Rs, slightly distal to strongly basal to cu-v. l. Jugal lobe less than half as long as vannal lobe, sometimes only one third as long. m. Hind tibia and basitarsus of female broad, basitarsus about twice as long as broad, ending in a broadly rounded or subtruncate apex above base of second tarsal segment. n. Tibial and basitarsal scopa (on outer sides of these segments) with a mat of strongly plumose hairs obscuring surface, from which emerge long simple bristles above the plumosity. o. Hairs of apex of hind basitarsus of female parted as in Macropis. q. Fore tarsi of female with small segments thickened and largely or entirely covered with short dense hairs, sometimes spatulate, sometimes plumose; these features sometimes somewhat developed on mid tarsus; front tarsus of female often elongated, and entire front leg in that case unusually slender. s. Seventh metasomal sternum of male with disc or body rather small, apex deeply bifid, a simple, membranous, lateral lobe before apex except in R. colorata new species, this lobe with appressed hairs or bristles on concave outer surface. t. Eighth metasomal tergum of male with apical process ending in a bevelled area which is longer than broad and not defined basally, apex often notched. v. Volsella with digitis extending posterior to cuspis as a tapering projection, shorter than in Melitta, with teeth along inner margin more or less opposable to those of cuspis.

Comments. Rediviva was originally described as a South African subgenus of Andrena. There exist species of Andrena in the Cape Region of Africa that superficially resemble the type species of Rediviva. As a result various authors (including Cockerell, 1933b) placed Rediviva in the Andrenidae, as a synonym or subgenus of Andrena, and Cockerell named the melittid group as Notomelitta in the belief that Rediviva was an Andrena. However, I have examined the type specimen of the type species of Rediviva from the Berlin museum. It is a melittid, clearly

a member of the group described above, and Notomelitta therefore falls into the synonymy.

The species of Rediviva look like those of Melitta, particularly resembling superficially the large species of Melitta such as M. capensis Friese. The most distinctive generic characters are d, e, g, m, n, o, and s.



Figures 93-96. Front legs of female Rediviva. 93, R. rufocincta (Cockerell). 94, R. colorata n. sp. 95, R. peringueyi (Friese). 96, R. longimanus n. sp. Scale line = 1.0 mm.

An interesting character of the genus is the thickening and dense pubescence of the fore and often mid tarsi of females (character q). This feature, together with characters m, n, and o, are in general agreement with Macropis and suggest that Macropis and Rediviva are closely related; perhaps these characters are synapomorphies related to oil collecting although nothing is known about that habit in Rediviva. Whatever the function of the fore tarsal pubescence of females, it must be exaggerated in females of certain species which have these tarsi and indeed the whole front leg greatly elongated (Fig. 96). These are forms in which the dense hairs of the fore tarsi are plumose. Species of this kind include R. peringueyi (Friese), a species near R. politissima (Cockerell) and neliana Cockerell, R. colorata new species and R. longimanus new species, the last showing the most extreme tarsal elongation. By contrast, some other species have front tarsi of normal length, with the pads made of dense spatulate rather than plumose hairs. R. rufescens (Cockerell) is such a species.

Another synapomorphy of Rediviva (with Redivivoides) is character g, the poorly defined, small propodeal triangle. Since the triangle is large in most short-tongued bees including most melittids, it is presumably a derived feature in Rediviva. The character is possibly the same as the "hairy propodeal triangle" of the subgenus Sinomacropis of Macropis. In Sinomacropis there is a small hairless basomedian area. Although undefined, this could be the triangle proper, in which case the large hairy area is not part of the triangle, and the situation would

be the same as in Rediviva. I did not interpret the homologies in this way in describing Sinomacropis because of the similarities in contours of the hairy areas of that subgenus to those of the large triangle of Macropis s. str.

Rediviva consists of a number of species, most of which are found in temperate South Africa although R. tropicalis from Zaire probably belongs here. Some of the species are described and keyed by Cockerell (1934). Species that fall in the genus are: R. neliana Cockerell, 1931b; peringueyi (Friese, 1911); politissima (Cockerell, 1934); longimanus new species; intermixta (Cockerell, 1934); tropicalis (Cockerell, 1934); colorata new species, and rufocincta (Cockerell, 1934). I have not seen specimens of R. intermixta and tropicalis. Probably some other African "Melitta" also belong here. I have seen about eight species of the genus from South Africa, but very few specimens of each, and some of them not identified.

Genus Macropis Klug (Figs. 68, 69)

Diagnosis. Melittinae with two submarginal cells; clypeus of male yellow; pygidial plate of male well developed.

Description. a. Male with clypeus, lower paraocular areas, and supraclypeal area yellow or partly so. b. Blade of galea margined with long hairs; galeal comb long, consisting of over 15 bristles. c. Ligular arm of labium short, base and apex not approaching base and apex of prementum. d. Labrum of male five to six times as wide as long, of female about four times, in both sexes narrowed laterally so that apical margin is convex, ends narrowly rounded, the whole lens-shaped. e. Surface of labrum impunctate. f. Malar area linear. g. Propodeal triangle variable (see subgenera). h. Forewing with two submarginal cells. i. Stigma slightly broader than in most Melittini so that length from base to base of vein r is less than twice greatest width. j. Not relevant because there are only two submarginal cells. k. Basal vein twice length of first abscissa of Rs or more, variable in relation to cu-v. l. Jugal lobe of posterior wing half as long as vanal lobe or longer. m. Hind tibia and basitarsus of female broad, basitarsus little over twice as long as broad, broadly truncated at about level of base of second tarsal segment, and with flattened, hairless, process projecting posteriorly from upper end of truncation (this process absent in M. patellata Patton). n. Tibial and basitarsal scopa of strongly plumose hairs with apices of some emerging as simple bristles above plumosity. o. Hairs of apical truncation of hind basitarsus of female, above base of second tarsal segment, parted (i.e., diverging) to expose narrow strip of integument along basitarsal apex. p. Hind basitarsus of male usually thickened, usually with coarse comb on under surface at least near base; apex subtruncate, often obliquely so, usually with short, bare projection below base of second segment. q. Fore and middle tarsi of female somewhat thickened and covered with dense, velvety hairs; small segments markedly more robust and also more densely hairy than small segments of hind tarsi. r. Pygidial plate of

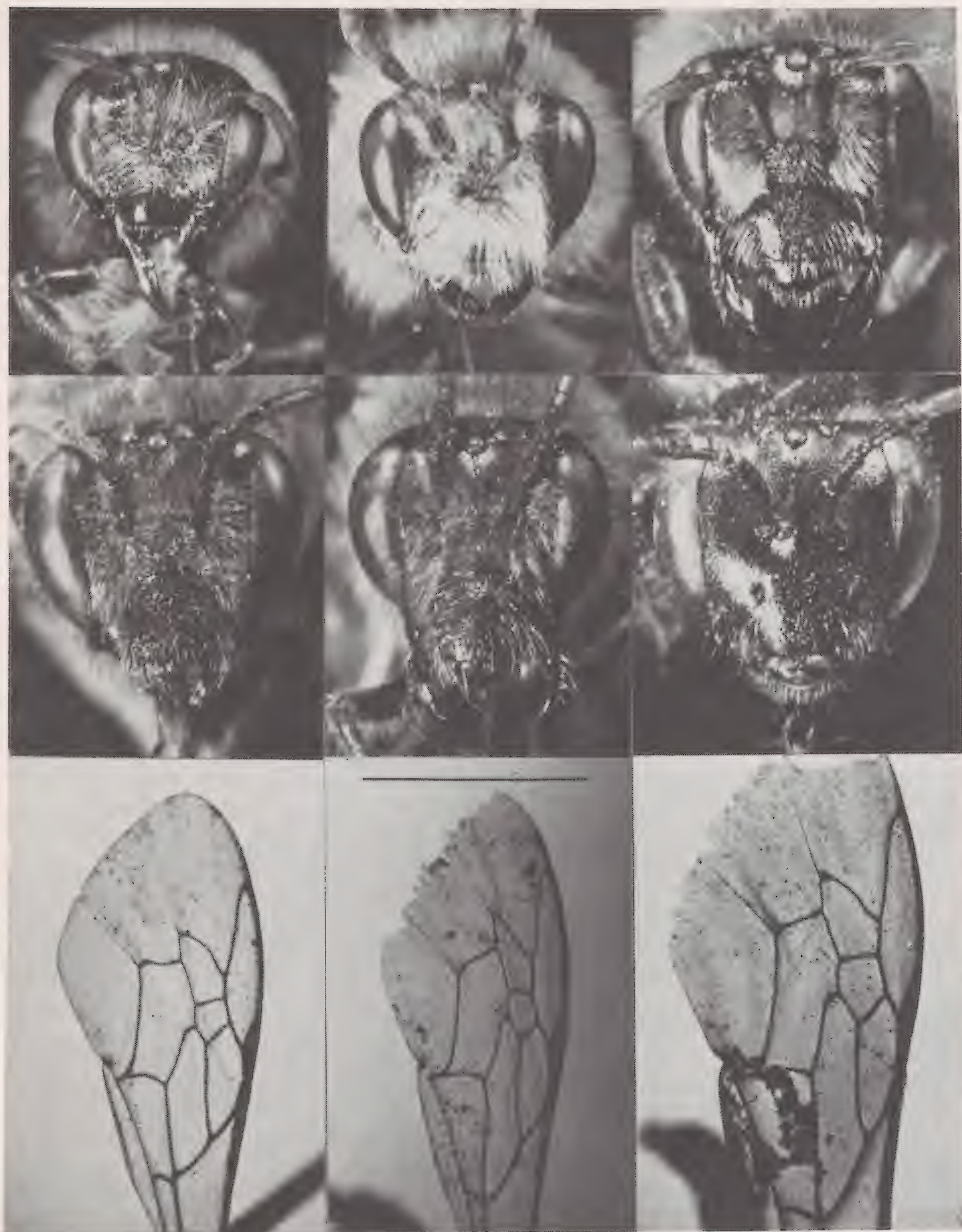


Figure 97. Melittinae. Top row, left to right, faces of Dolichochoile melittoides Viereck, female; Redivivoides simulans n. sp. male, female holotype. Middle row, left to right, faces of Rediviva colorata n. sp., female holotype, male; R. longimanus n. sp., female holotype. Bottom row, left to right, forewings of Dolichochoile melittoides Viereck, Redivivoides simulans n. sp., Rediviva longimanus n. sp., holotype. Scale line = 0.5 mm.

male strongly developed, greatly elevated above adjacent tergal surface. s. Seventh metasomal sternum with disc or body of sternum small; apical lobes on each side large, complexly folded, setose. t. Eighth metasomal sternum with apical process not ending in bevelled area suggestive of a pygidial plate; base of eighth sternum truncately produced, spiculum not projecting. u. Gonostylus slender at base, usually expanded and bilobed or bifid apically, distinctly articulated to gonocoxite. v. Volsella with digitis and cuspis of about equal length, toothed along opposing margins.

Comments. The characters of females, as well as those of mouth-parts, and the comb mentioned under item p, have not been verified for the subgenus Paramacropis.

Possible apomorphic characters for this genus include a and h. Both of these are features that appear in many other bees. A yellow clypeus (part of character a) even occurs in one genus of Dasypodinae (Promelitta) and two submarginal cells (character h) characterizes the Dasypodinae. It is not clear whether these features arose in an ancestral Macropis or in a common ancestor of that genus and Dasypodini.

Characters m, n, o, and q, are unusual features, not found in other bees except Rediviva. As noted in discussing the subfamily, they are complex features; it seems unlikely that they arose twice. They could be synapomorphies for the subfamily, secondarily lost in those that lack them. On the other hand, they could have arisen within the Melittinae, one group of which (Rediviva) then gave rise to Macropis. But if this were true, how does it happen that Macropis possess plesiomorphies like character r and the articulated gonostyli of u, not possessed by any other Melittinae? As to character r, the pygidial plate is doubtless a plesiomorphy in bees, being derived from that of sphecoid wasps. It is present in all female melittids. It is possible that it was lost in males, but since genes for it are present it could have been restored in males of Macropis and feebly in Redivivoides (as well as some Hesperapis in the Dasypodinae) by activating in the males genes that had been functioning only in females. For character u (articulated bases of gonostyli, likewise, one can argue that the (for Hymenoptera) plesiomorphy of a freely articulated gonostylus may for Macropis be a reversion and thus a synapomorphy, for there is enormous variation in this feature among bees, and in fact the condition is found also in some Dasypodinae which in other features have no special similarity to Macropis. In short, we have no clear bases for choosing between these parts of the cladograms shown in Figures 1 and 2, or between those and a third alternative involving characters 48, 49, 51, and 52 on the stem for the subfamily with reversals for those characters on the stems for Melitta (with Dolichochile) and Redivivoides.

An adequate analysis of the subgenera of Macropis is not possible since Paramacropis is not known to me in the female sex. In couplet 2 of the following key, the female of Paramacropis would presumably run to Macropis s. str.

Key to the Subgenera of Macropis

1. Gonostylus of male slender, simple; sternum VI of male with broadly truncate apical process; sternum VIII with apical process much broader than body of sternum, densely covered with long hairs.

(Female unknown; found in maritime province of Siberia).

-----Paramacropis

- Gonostylus of male apically expanded and bilobed or bifid; sternum VI of male with apex attenuate; sternum VIII of male with apical process much narrower than body of sternum, apically pointed, with hairs of moderate length.

-----2

- 2. Propodeal triangle punctate, hairy except for small median area (China).

-----Sinomacropis

- Propodeal triangle impunctate, hairless, either smooth or rugose (Holarctic).

-----Macropis s. str.

Subgenus Macropis Klug s. str.

Megilla Fabricius, 1805, p. 328.

Type species: Megilla labiata Fabricius, 1805, designated by Westwood, 1840, p. 158. A subsequent designation by Richards (1935, p. 172) of Apis acervorum Linnaeus, 1758, would make Megilla a synonym of Anthophora.)

Macropis Klug, in Panzer, 1809, pt. 107, no. 16.

Type species: Megilla labiata Fabricius, 1804, monobasic.

Diagnosis. Propodeal triangle large, hairless; gonostylus of male expanded apically, bifid or bilobed.

Description. a. Labrum of female with a transverse ridge across it. b. Maxillary palpus six-segmented. c. Propodeal triangle large, hairless, smooth or transversely wrinkled, not punctate. d. Basal vein interstitial with or basal to cu-v. e. Hind basitarsus of male with comb of stiff bristles on underside, extending nearly the full length of the segment. f. Hind basitarsus of male less than half as long as tibia, less than four times as long as broad, with ventroapical projection bilobed. g. Sixth sternum of male with apex attenuate, down curved, with retrorse hairs. h. Eighth sternum of male with apex a narrow, acutely pointed process, somewhat constricted preapically. i. Male gonostylus narrow at base but broadened apically, strongly bifid.

Comments. This subgenus is a widespread visitor of Lysimachia in eastern North America, west to eastern Washington State, and across Eurasia from western Europe to Japan (Popov, 1958). It probably collects oil as well as pollen from this plant (Vogel, 1976). Its nesting biology was described by Malyshev (1929) and Rozen (1980). The west-Palearctic species were reviewed by Warncke (1973).

Illustrations of male genitalia and associated structures have been provided by Saunders (1882), Mitchell (1960), and Michener (1938).

Benson, Ferrière and Richards (1947) and Michener (submitted) have requested suspension of the rule of priority for the name Megilla and preservation of the well established name Macropis for this group of bees.

Sinomacropis Michener new subgenus

Type species: Macropis hedini Alfken, 1936.

Diagnosis. Propodeal triangle hairy (or greatly reduced in size); gonostylus of male expanded apically, bilobed or bifid.

Description. Agrees with that of Macropis s. str. except as follows: a. Labrum of female evenly convex, as in male. c. Propodeal triangle shining, with well separated punctures and with hairs except on small, ill-defined median area (which is possibly the triangle proper). d. Basal vein distal to cu-v. e. Hind basitarsus of male with comb of stiff bristles on under side of base only. f. Ventroapical projection of hind basitarsus of male not bilobed.

Comments. Alfken (1936) as well as Popov and Guiglia (1936) suggested that Macropis hedini could fall in a new genus. The males of the group, here described for the first time, show the close similarity to Macropis s. str., but subgeneric rank is justified. This subgenus is known from at least three species, all from Sichuan (=Szechuen) Province, China, only one of them described. All are represented by specimens in the U. S. National Museum. The two Japanese species of the genus fall in Macropis s. str. to judge by the descriptions (Yasumatsu and Hirashima, 1956).

The most noteworthy subgeneric character of Sinomacropis is the punctate and hairy propodeal triangle (hairless only in a small median area). Among bees the hairy vs. hairless propodeal triangle is usually a conservative variable, characteristic of families or groups of families; most short-tongued bees have a hairless triangle. A hairy propodeal triangle is not found in any other melittids.

Other features of the subgenus, not mentioned in the above description, include more extensive yellow areas than in other Macropis. In M. hedini the supraclypeal area of the female has a yellow spot, and in males of all species there are small to extensive yellow areas on the femora, tibiae, and tarsi. In some males the posterior margins of the first few metasomal terga are dull yellowish.

The female of M. hedini has the first two metasomal terga largely red, a feature not found in the male or in the other species of the genus. M. hedini was originally described from the female only. Popov (1958) described what he believed to be the male. However, it appears that he had the male of another species of the subgenus, as shown, for example, by the long, thin, mediotarsal segments of the middle leg (Popov, 1958, Fig. 1). Such a middle tarsus is characteristic of another species but not of the male associated with M. hedini in the U. S. National Museum (Washington). Popov's illustrations adequately represent the subgeneric characters of the sterna and genitalia, even though probably not correctly attributed to the type species of the subgenus.

Etymology. Sino- pertaining to China; plus the generic name Macropis.

Subgenus Paramacropis Popov and Guiglia

Paramacropis Popov and Guiglia, 1936, p. 287.

Type species: Ctenoplectra ussuriana Popov, 1936, monobasic.

Diagnosis. Male gonostylus simple, not expanded or lobed apically. (Female unknown to me.)

Description [based entirely on Popov's (1936) description and figures of the male]. Agrees with Macropis s. str. except as follows: b. Maxillary palpus five-segmented. c. Propodeal triangle hairless, smooth. d. Unknown. f. Hind basitarsus of male over half as long as tibia, over four times as long as broad, probably without comb and ventroapical projection. g. Sixth sternum of male narrowed preapically, then broadened to truncate, hairy apex. h. Eighth sternum of male with apex greatly broadened behind preapical constriction, much broader than any other part of sternum, under (?) side of process densely covered with long hairs. i. Male gonostylus slender, simple.

Comments. This subgenus, from the maritime province of Siberia, is markedly different from other Macropis in characters g, h, and i. Character b should be verified, since nearly all melittids have six-segmented maxillary palpi.

Subfamily Dasypodinae

Diagnosis. Differs from other subfamilies in having paraglossae that, if present, are largely bare, with hairs usually present only apically; except for Promelitta, paraglossae that are much shorter than their suspensoria (or absent); two submarginal cells, the second usually shorter than the first; and base of second submarginal cell (first transverse cubital vein) usually at nearly right angles to the longitudinal veins on either side and close to the first recurrent vein.

Description. Agrees with description of Melittinae except as follows: a. Body minute (4mm long) to rather large (14mm long), without yellow markings except for some Eremaphanta and the yellow clypeus of male Promelitta and the partly yellow clypeus of the male Hesperapis rufipes. c. Paraglossa absent or much shorter than suspensorium except in Promelitta, largely hairless but with some apical hairs, not annulate. e. Labrum frequently with strong transverse ridge (otherwise as in Melittinae). f. Frontal line frequently a groove on a slightly to strongly convex region between antennal bases. g. Malar area linear or nearly so, about as long as width of first flagellar segment in some Sambini. h. Clypeus usually without longitudinal median ridge, but with strong ridge in Samba. j. Forewing with two submarginal cells [three on one side only of a specimen of Eremaphanta convolvuli (Popov)], second shorter than first (subequal to first in some Sambini), strongly narrowed toward costal margin of wing. Base of second submarginal cell usually nearly at right angles to longitudinal veins, close to first recurrent vein. k. Basal vein 1.3 to 3.5 times as long as first abscissa of Rs. l. Stigma less slender than in Meganomiinae, large and broad in Eremaphanta, prestigma one fifth to over two thirds as long as stigma; vein r arising near middle of stigma or (in some Eremaphanta and Dasypoda) at apical third; sides of stigma basal to vein r usually converging toward base of stigma, only slightly so in some, margins parallel in a few. m. As in Melittinae or apex of marginal cell not at all bent away from costal margin of wing (Eremaphanta). n. Jugal lobe of hind wing one fourth to over three fourths as long as vannal lobe. o.

Mid and hind basitarsi of female narrower than tibiae. p. Hind basitarsus of female usually tapering slightly distally, apex usually narrow and giving rise to segment 2 medially but in Promelitta and the Sambini apex broader, giving rise to segment 2 at lower margin, apex above base of segment 2 sometimes produced distally, hairs on apical margin not parted as in Macropis. q. Metasomal hair bands absent in some Eremaphanta, some Hesperapis, and in Sambini; prepygidial and pygidial fimbriae weak in some Dasypodini. r. Depressed apical zones of terga sometimes narrower than in Melittinae. s. Lateral extremities of tergal graduli not curved posteriorly or only extending a short distance posteriorly (in Promelitta, about as in Melitta). u. Sternum VII of male a transverse plate with two apical lobes, not very different from preceding sterna, or disc reduced with lateroapical lobes.

Comments. The characters listed under c and j above are synapomorphies of the subfamily; c is the most reliable. The transverse base of the second submarginal cell, more or less at right angles to the longitudinal veins and close to the apex of the second recurrent vein, is an unusual feature not found in related bees. Unfortunately it is less than fully satisfying because the difference between transverse (as in Dasypodinae) and slanting (as in Macropis and the groups with three submarginal cells) is small and sometimes almost bridged by variation within genera or even species. Nonetheless, the character is a valuable one used with care and does in general distinguish most Dasypodinae from other melittids. Character s also distinguishes Dasypodinae (except Promelitta) from other Melittidae (except Rediviva and Redivivoides), but it is not clear whether it is an apomorphy or plesiomorphy. The other characters listed above do not distinguish all Dasypodinae from all Melittinae, but are given to indicate ranges of variation.

Larvae of Dasypoda, Capicola s. str. and various subgenera of Hesperapis are known (Rozen and McGinley, 1974). While Dasypoda is quite different from the other two genera, all three exhibit several apomorphies that distinguish them from the Melittinae and Meganomiinae, and thus support recognition of the subfamily Dasypodinae. Unfortunately larvae of the tribes Sambini and Promelittini are unknown.

Key to the Tribes of Dasypodinae

1. Vertex seen from front (except in Eremaphanta s. str.) elevated well above summits of eyes, usually convex; gonostylus of male (except in Dasypoda) robust, fused to gonocoxite; sternum VII of male without or (in some Dasypoda) with a pair of slender, strip-like lateroapical lobes; paraglossa small, slender, cylindrical.
-----Dasypodini
- Vertex seen from front little elevated above summits of eyes, gently convex to concave; gonostylus of male long, flexibly joined or articulated to gonocoxite; sternum VII of male with one or two pairs of broad, lateroapical lobes; paraglossa tapering distally or absent.
-----2
2. Clypeus of male largely yellow; metasomal terga with basal zones of pale hair; paraglossa nearly as long as its suspensorium; vertex

weakly, uniformly convex seen from front.

-----Promelittini

- Clypeus concolorous with rest of head; metasomal terga without basal hair bands, bands if present apical; paraglossa much shorter than suspensorium or usually not recognizable; vertex straight or concave seen from front.

-----Sambini

Promelittini new tribe

This tribe, so far as known, contains only a single Egyptian species which does not readily fall into either of the other tribes. Another species of doubtful affinities from southern Africa is tentatively included. The principal tribal characteristics are indicated in Table 2, the apomorphies in Figures 1 and 2. Since Promelitta does not have the numerous distinctive characters of the Sambini (Figs. 1 and 2), it is more similar to the Dasypodini than to the Sambini. However, there are features in which it resembles the Sambini and differs from the Dasypodini. Some such features are probable plesiomorphies like the large lateroapical lobes of sternum VII of the male (plesiomorphy for characters 89 and 90, Table 1); others are apomorphies shown in Figure 1.

In various features Promelitta resembles the Melittinae rather than other Dasypodinae. The base of the second submarginal cell is equivocal: as in some Sambini it slopes more than in most Dasypodinae but less than in Melittinae. The tergal graduli, however, are about as in Melitta; the free margin of the marginal cell is slightly concave so that the distal part of the cell is slender, as in Melitta; and the sixth tergum of the male is not bilobed but has a median, apical, hairy area, as in Melittinae.

Thus on the basis of similarity, Promelitta could almost be placed in the Melittinae. The characters indicating its affinities to other Dasypodinae are indicated in Figures 1 and 2. It is probably an archaic type, like several other bees of the Palearctic deserts. Perhaps it is a derivative of Melittinae, survivor of the group from which Dasypodini and Sambini arose, as suggested by Figure 2.

Genus Promelitta Warncke (Figs. 98-106; Sketches A-C)

Melitta (Promelitta) Warncke, 1977, p. 59.

Type species: Dufourea alboclypeata Friese, 1900, by original designation and monotypy.

Diagnosis. Clypeus of male largely yellow; metasomal terga with basal, not apical, bands of hair; paraglossa nearly as long as its suspensorium, tapering at apex, largely bare but hairy apically.

Description. a. Body of moderate size (9mm long), moderately hairy; clypeus of male yellow except for marginal zone all the way around. b. Head broader than long, nearly as wide as thorax; vertex convex seen from front. c. Labrum of male over five times as wide

TABLE 2. CHARACTERS OF THE TRIBES OF DASYPODINAE.

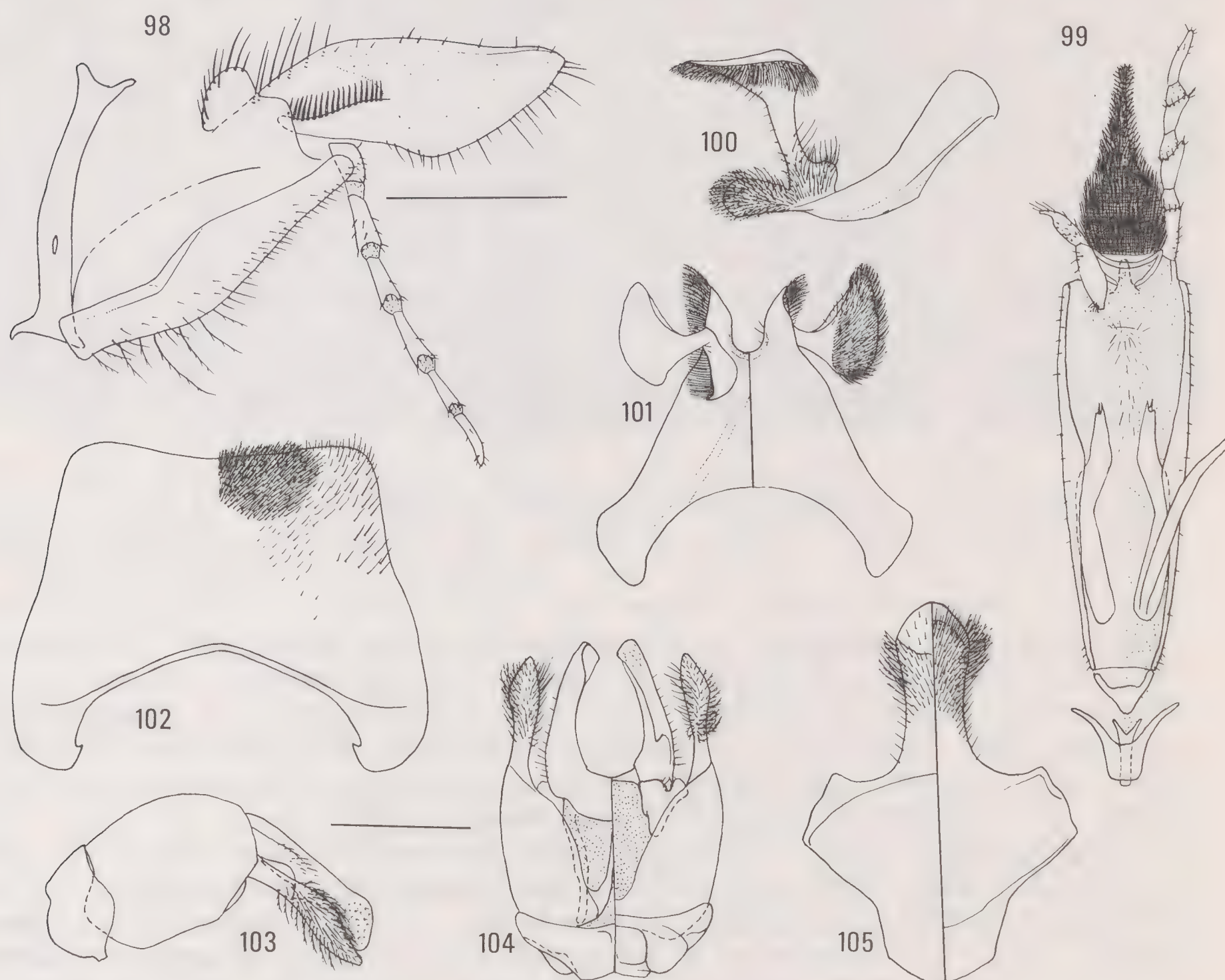
<u>Clypeus male</u>	<u>Head</u>	<u>Minimum distance between eyes female</u>	<u>Vertex seen from front</u>	<u>Paraglossa</u>	<u>Posterior marginal flange of stipes</u>	<u>Upper metapleural pit</u>	<u>Profile of propodeum</u>	<u>Posterior basitarsus female</u>	<u>Jugal lobe of hind wing</u>
yellow	about as wide as the thorax	less than length of eye	weakly convex	nearly as long as suspensorium, with tapering apex	absent	normal	basal part more nearly horizontal than the rest	with large apical projection above base of segment 2	about half as long as vannal lobe
black	often narrower than thorax	commonly less than length of eye	elevated above summits of eyes, usually convex	small, cylindrical	absent	normal	basal part usually more nearly horizontal than the rest	without such projection	one fourth to three-fourths as long as vannal lobe
black	about as wide as thorax	nearly equal to or greater than length of eye	straight to concave	small, with tapering apex, or absent	present	inconspicuous, posterior to lower pit	sloping but more or less in one plane	with or without small apical projection above base of segment 2	less than half as long as vannal lobe

Michener: Classification of Melittidae

Table 2 (continued)

Apical tergal hair bands	<u>Promelittini</u> absent	<u>Dasypodini</u> usually present	<u>Sambini</u> usually absent
Basal tergal hair bands	present	absent	absent
Tergal graduli	bent posteriorly at sides, not or scarcely bent extending about half way to tergal margins	not or scarcely bent posteriorly	present
Longitudinal median elevated area of pygidial plate female	present	absent (except in <u>Capicola</u>)	large
Lateroapical lobes of sternum VII male	large	absent or small and slender	large
Mesoapical lobe of gonocoxite male	absent	absent	yes
Gonostylus enlarged apically, biangulate	no	no	elongate, not opposable to cuspis
Volsellar digitis	normal	normal	elongate, distinct
Gonostylus	elongate, distinct	broad, fused to gonocoxite (except in <u>Dasypoda</u>) ²⁰³	

as long; smooth, shining, convex; hairs only along extreme apical margin. d. Labrum of female similar to that of male but with indication of transverse basal convexity. e. Flagellar segments of male mostly longer than broad but segment 2 much broader than long, 1 shorter than 3, 4, etc. f. Flagellar segments of female mostly broader than long, but 1 and 10 longer than broad, 2 shortest, about twice as broad as



Figures 98-105. *Promelitta alboclypeata* (Fries), male. 98, 99, Inner view of maxilla and anterior view of labium. 100, 101, Sternum VII (lateral, dorsal, and ventral). 102, Sternum VI (ventral). 103, 104, Genitalia (lateral, dorsal and ventral). 105, Sternum VIII (dorsal and ventral). Scale lines = 0.5 mm; one scale is for mouthparts, the other for abdominal structures.

long. g. Maxillary blade little over twice as long as broad, tapering from near base to apex, with fringe of scattered, rather long hairs; maxillary palpus extending much beyond apex of blade. h. Galeal comb well developed. i. Prementum rather robust; ligular arm arising about a premental width distad to base of prementum, end jagged, about two thirds of distance from base to apex of prementum. j. Glossa rather short but with a slender, attenuate apex; labial palpus extending beyond apex of glossa. k. Paraglossa small, hairy, attenuate apically, as long as suspensorium. l. Second and third segments of labial palpus with apices oblique, laterally produced. m. Basal vein 1.5 to 1.7

times as long as first abscissa of Rs, curved throughout, distal to cu-v. n. Stigma of moderate size, less than half as long as costal margin of marginal cell; vein r arising little beyond middle of stigma; margins of stigma basal to vein r converging basally; length from base to base of vein r about twice greatest width of stigma. o. Prestigma less than half as long as stigma. First recurrent and first transverse cubital veins well separated. p. Apex of marginal cell pointed, separated from wing margin by less than a vein width. q. Jugal lobe of hind wing half as long as vannal lobe. r. Propodeal triangle smooth, shining, basal zone longer than metanotum, horizontal, curving onto declivous posterior face of propodeum. s. Basitibial plate well defined in both sexes, rather small, rounded apically. t. Scopa rather dense (but one can see integument through it), of moderately long, simple hairs, yellow on under side of basitarsus; tibia with scopa-like hairs except for nearly bare, smooth zone on underside and zone about half as wide as tibia of keirotichia with minutely bifid tips on posterior (inner) surface, these two zones separated by a zone of long scopal hairs. u. Mid and hind tibial spurs only gently curved apically, their margins minutely and densely microserate ("ciliate"). v. Middle and hind basitarsi of female flat, nearly parallel-sided, slender, over four times as long as broad, somewhat narrower than tibia; hind basitarsus giving rise to segment 2 below middle of apex, upper apical angle produced distally as broad, flat blade which is nearly bare on anterior (outer) surface. w. Middle and hind basitarsi of male somewhat flattened, slightly tapering; hind basitarsus ending in narrow truncation with segment 2 arising below middle of apex. x. Distitarsi somewhat enlarged, distinctly broader than preceding segments. y. Claws cleft nearly to middle, inner rami much shorter (an inner tooth) in female than in male. z. Metasomal terga I-IV of females and I-V of males with broad, depressed, finely punctate, minutely hairy apical zones. aa. Terga without apical or preapical hair bands, but terga II to V with conspicuous, broad basal bands of white, appressed hair. bb. Pygidial plate of female well defined, dull, apex rounded, surface with abruptly elevated longitudinal median zone. cc. Pygidial plate of male absent. dd. Sixth sternum of male with apex broadly truncate, median third of apical part slightly elevated and covered by patch of dense hairs. ee. Seventh sternum of male with rather reduced disc, bifid apex, and long, pedunculate, lateroapical lobe that is hairy distally. ff. Eighth sternum of male with strong apical process that is abruptly truncate to form a plate (like a false pygidial plate) apically. gg. Gonostylus of male simple, hairy, about as long as gonocoxite, articulation (rather than fusion) to gonocoxite distinct.

Comments. The genus is known from a single Egyptian species, Promelitta alboclypeata (Fries, 1900), and perhaps from P. plumipes (Fries, 1912), new combination, a South African species described under the generic name Rhinochaetula. The latter species (see Sketches A-C) may represent another (new) genus, perhaps not even in this tribe, but it is known only from a female specimen in the Berlin Museum; the characters of the male are therefore unknown. It differs from the female of P. alboclypeata as described above in the following features: b. Head even broader, inner orbits diverging below instead of converging. d. Labrum less than four times as long as broad. f. Flagellar segment 1 about 2.5 times as long as broad. g. Maxillary blade nearly four times as long as broad. j. Apex of glossa not slender, at-

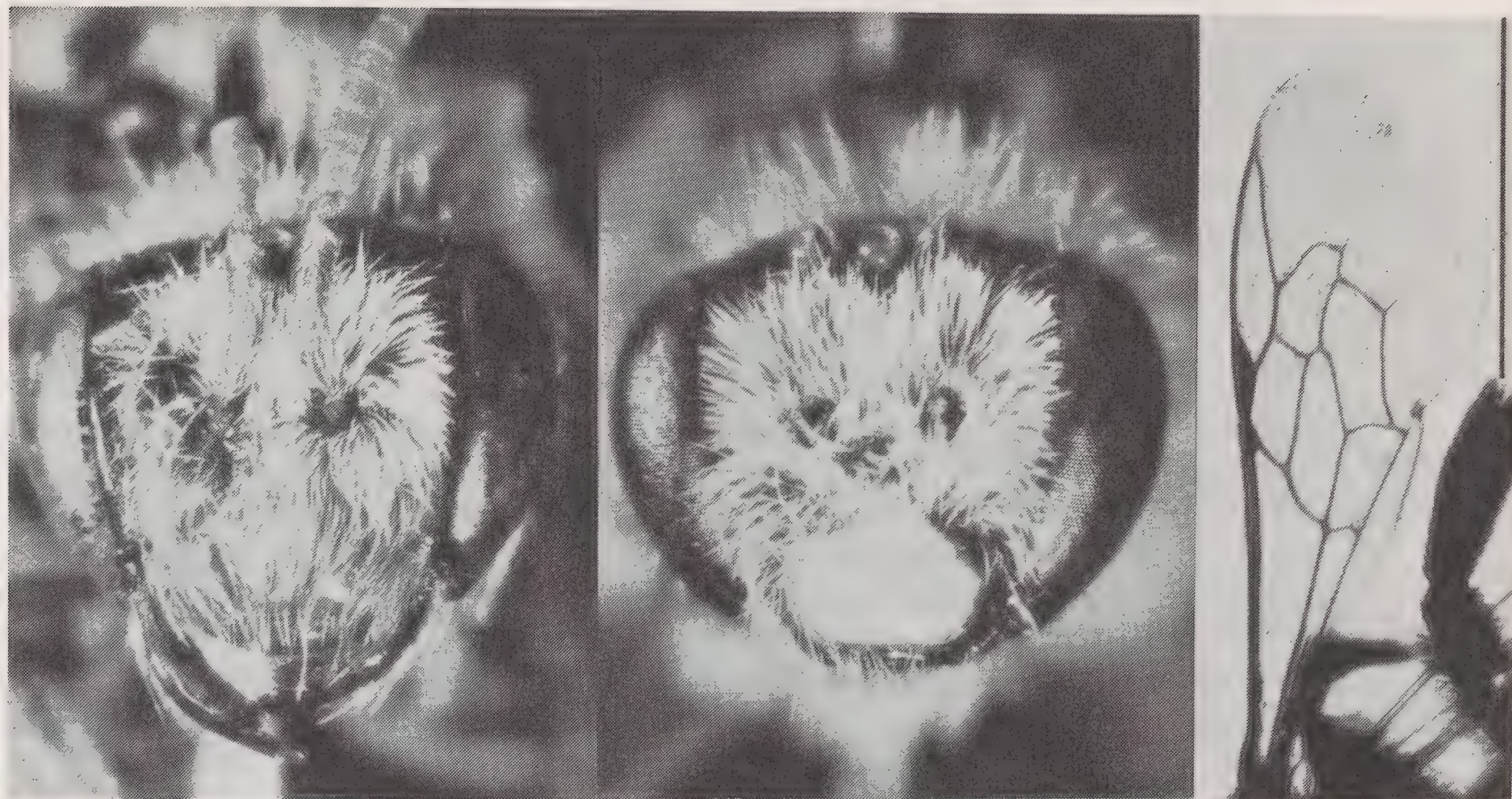
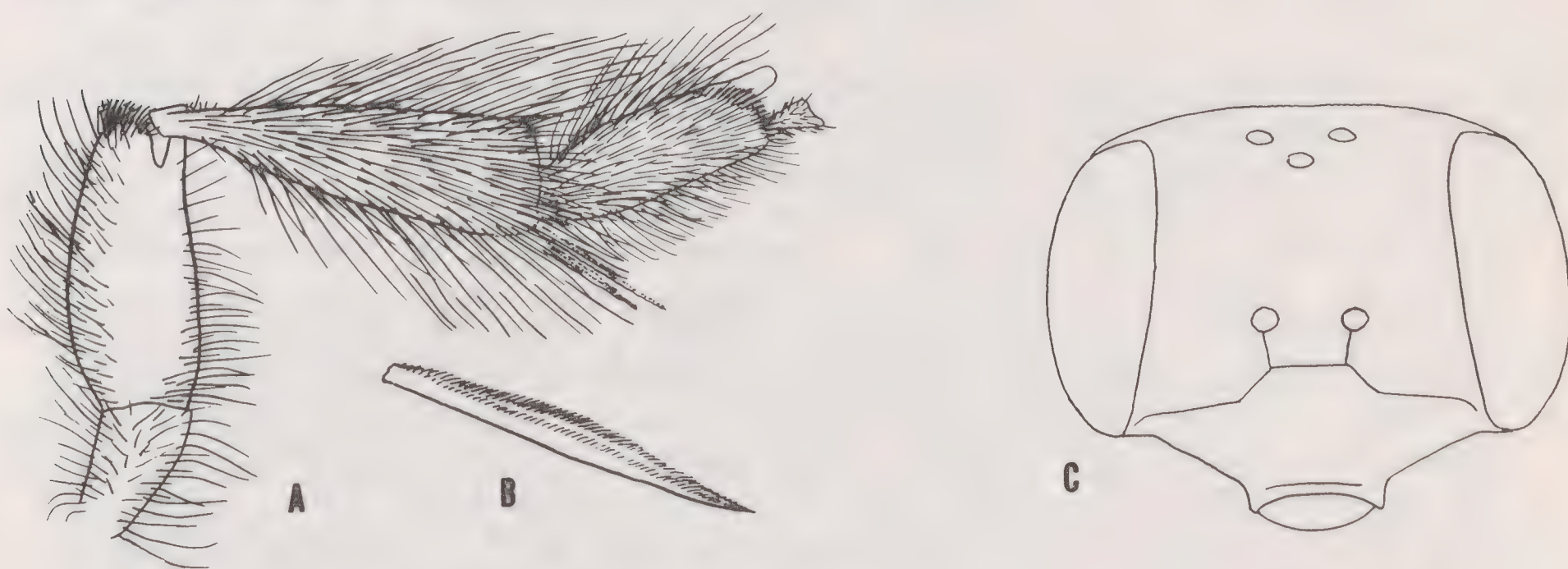


Figure 106. Promelitta alboclypeata (Fries). Left to right, faces of female, male type and forewing. Scale line = 0.5 mm, applicable only to wing.

tenuate. l. Segments of labial palpus not obliquely produced at apices. p. Apex of marginal cell less sharply pointed than in P. alboclypeata. t. Keirotichia absent, the tibia being covered with scopula-like hairs. Apex of hind basitarsus, on outer side, with oblique row of close spaced, posteriorly directed coppery hairs extending from near base of segment 2 to upper margin of basitarsus basal from upper distal process. y. Claws not so deeply cleft as in P. alboclypeata, the inner tooth arising beyond middle. z. Basal hair bands restricted to metasomal terga II and III. bb. Pygidial plate of female without elevated median zone.



Sketches A-C. Promelitta plumipes (Fries). Freehand sketches of holotype (female). A, Outer view of hind leg. B, Inner hind tibial spur. C, Face.

It seems quite likely that P. plumipes is not closely related to P. alboclypeata but until the male of the former can be found, there is no justification for erecting a new genus for it. It falls better in Promelitta than in other genera; placing it here at least calls attention to its lack of close relationship to Capicola, where most of Friese's other species of Rhinochaetula fall.

Sambini new tribe

This African tribe can be recognized by the characters indicated in the key to tribes and in Table 2. Its numerous synapomorphies are also indicated in Figures 1 and 2.

The short, broad head with a flat or concave vertex, exaggerated in Samba, tends to be characteristic of the whole tribe. The paraglossae are greatly reduced, often absent or indistinguishably fused to the apices of the suspensoria, but in Prosamba they are distinct although small and tapering apically. The elongate volcellar digitis is suggestive of that of Melitta but presumably arose independently.

The known species of Sambini are all very different from one another. They may be remnants of a formerly larger fauna.

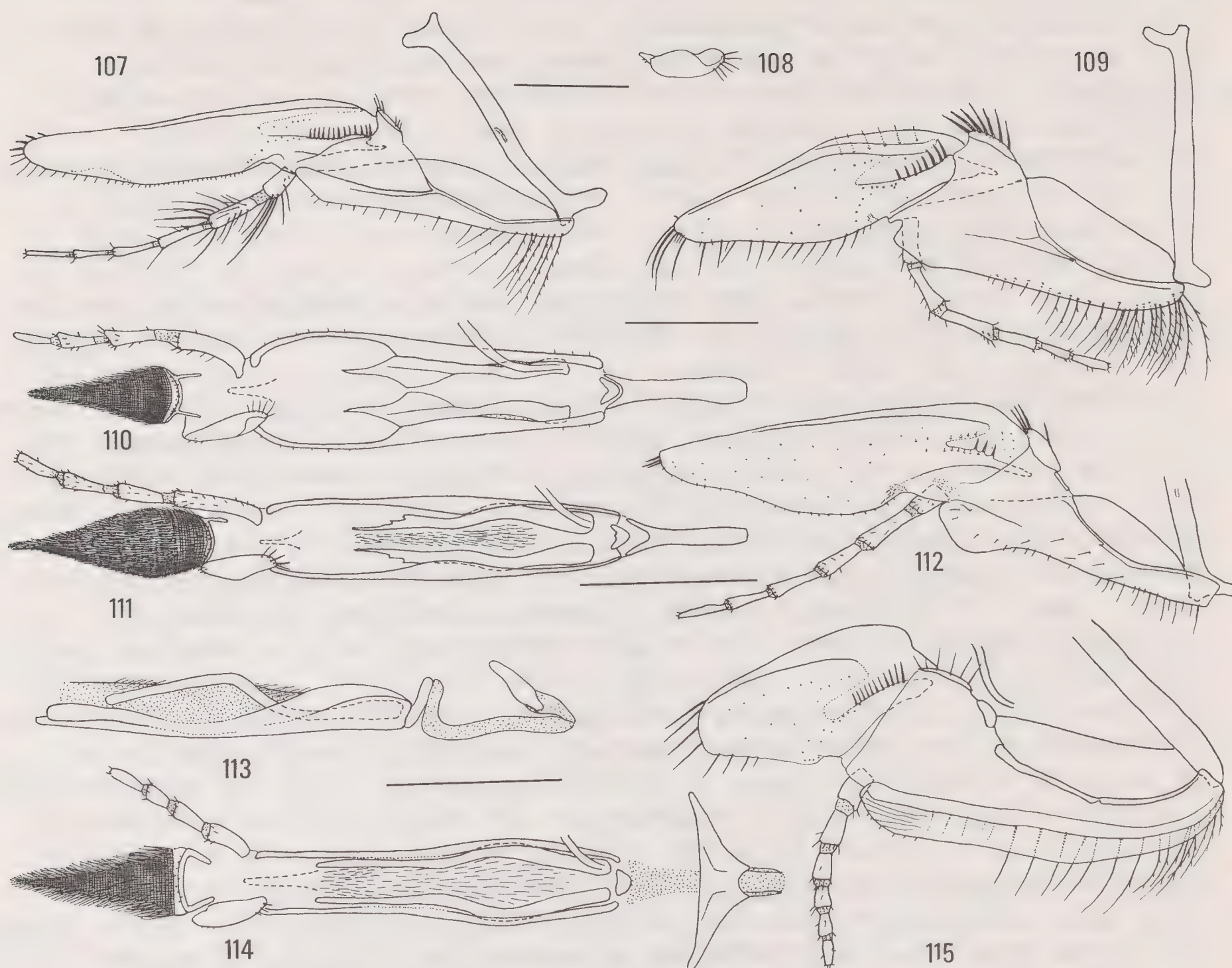
Key to the Genera of the Tribe Sambini

1. Female with only one hind tibial spur; vertex strongly concave seen from front; hind basitarsus of male with hairy pocket near base of outer surface.
-----Samba
- Female with two hind tibial spurs; vertex not or scarcely concave; hind basitarsus of male without hairy pocket.
-----Haplomelitta

Genus Haplomelitta Cockerell

Diagnosis. Female with two hind tibial spurs as in most bees; hind basitarsus of male without large hairy pit on outer surface near base.

Description. a. Body of moderate size (7-14 mm long), not densely hairy. b. Head about as broad as thorax; clypeus about three times as wide as long, not or scarcely overhanging base of labrum medially; minimum distance between eyes about equal to or slightly more than length of eye in females, slightly to greatly less than length of eye in males; vertex concave, straight, or feebly convex seen from front. c, d. Labrum of both sexes about four times as wide as long with a strong, rounded, transverse ridge; surface basal to ridge smooth, gently convex, shining, hairless; surface distal to ridge mostly dull, with punctures and hairs basal to long marginal bristles. e, f. Flagellar segments variable in relative lengths; see subgeneric descriptions. g. Maxillary blade three to more than four times as long as broad, apex bluntly pointed, with or without a few long hairs; palpus extending but little beyond apex of blade. h. Galeal comb present, reduced to three bristles in Haplomelitta s. str.; flange on posterior side of stipes



Figures 107-115. Mouthparts of Sambini. 107, 108. Inner view of maxilla and anterior view of paraglossa of Haplomelitta (Prosamba) griseonigra n. sp. 109, 110, Inner view of maxilla and anterior view of labium of H. (Atrosamba) atra n. sp. 111, 112, Same, H. (Haplomelitta) ogilviei (Cockerell). 113, Lateral view of prementum, mentum and lorum of Samba calcarata Friese, anterior surface upward. 114, 115, Anterior view of labium and inner view of maxilla of same. Scale lines = 0.5 mm; scale is the same for all figures of any one species.

limited to distal part of stipes near base of palpus, in Haplosamba flange not so evident and perhaps best considered as extending along posterior side of stipes. i. Prementum not especially slender; ligular arm full length or moderately shortened, distal part sharp or jagged. j. Glossa rather attenuate, not or scarcely exceeding labial palpi. k. Paraglossa absent or unrecognizable, perhaps a robust, tapering structure at ends of suspensorium, or present as a small tapering projection in Prosamba. l. Segments of labial palpus with apex not strongly produced laterally. m. Basal vein two to nearly four times as long as first abscissa of Rs, weakly curved, basal or distal to cu-v. n. Stigma of moderate size, more than to slightly less than half as long as costal margin of marginal cell (sometimes so tapered apically that its

apex and measurements involving it are judgemental); vein r arising at or a little before middle of stigma; margins of stigma basal to vein r only slightly converging basally; length from base to base of vein r slightly more to slightly less than twice greatest stigmal width. o. Prestigma a little less than to well over one third as long as stigma. First recurrent vein variable relative to first transverse cubital. p. As described for Samba. q. Jugal lobe of hind wing one fourth to nearly one half as long as vannal lobe. r. Propodeal triangle shining, sometimes (Haplomelitta s. str.) roughened by a series of pits or ridges, defined by weak or strong lines, surface as seen in profile in about the same plane as rest of propodeum, at a steeper angle relative to body axis than in Samba. s. Basitibial plate as described for Samba but surface not always hairy. t. Tibial and basitarsal hairs as described for Samba but no plumose hairs beneath scopal hairs. u. Hind tibial spurs two, rather slender and microserrate ("ciliate") except for modified inner spur of male of Metasamba. Middle tibial spur microserrate, sometimes thickened and toward apex strongly curved. v. Middle and hind basitarsi of female flattened, margins of middle basitarsus convex so that it is wider medially than at ends; hind basitarsus narrower than middle one, margins nearly straight, parallel, or in Metasamba hind as broad as middle basitarsus, margins slightly convex and converging distally. Apices of middle and hind basitarsi rather narrowly truncate (sometimes obliquely), second segment arising from lower part of truncation, upper part of truncation usually produced as an angle or spine above base of second segment on hind leg and sometimes also on mid leg. w. Middle basitarsus of male somewhat flattened, variable in form; hind basitarsus of male flattened or inflated, without hairy pit on outer surface. x. Distitarsi slightly swollen, broader than preceding segments. y. Claws cleft as in Samba. z. As in Samba but apical zones less well defined, narrower (so that line across tergum is much closer to posterior tergal margin than to gradulus), and in Metasamba punctate and hairy, forming apical hair bands. aa. Terga without hair bands except for apical ones in Metasamba. bb. Pygidial plate of female as in Samba, elevated zone broad and weakly differentiated in Haplosamba. cc. Pygidial plate of male absent. dd. Sixth sternum of male with apex bilobed. ee. Sternum VII of male deeply medially notched at apex, with two pairs of membranous lateroapical lobes, one often sessile and sometimes not differentiated as a lobe, but hairy on one surface. ff. Sternum VIII with robust apical process, its upper apical surface in situ often resembling a pygidial plate. gg. Gonostylus of male as long as or longer than gonocoxite, well differentiated, slender, with enlarged, angulate apex.

Comments. This genus contains only five species known to me, all from arid parts of western South Africa and Namibia. These species are so different in both structure and appearance that I originally planned to accord each generic rank. However, as suggested by Figures 1 and 2, the number of differentiating apomorphies is not great, and I hesitantly reduced each taxon to subgeneric rank. The resulting genus Haplomelitta is paraphyletic because Samba is derived from it. Such a classification seems to me more useful than one which slavishly mirrors the cladistic pattern. The five species of Haplomelitta, however, seem more different from one another than many apoid genera.

Key to the Subgenera Haplomelitta

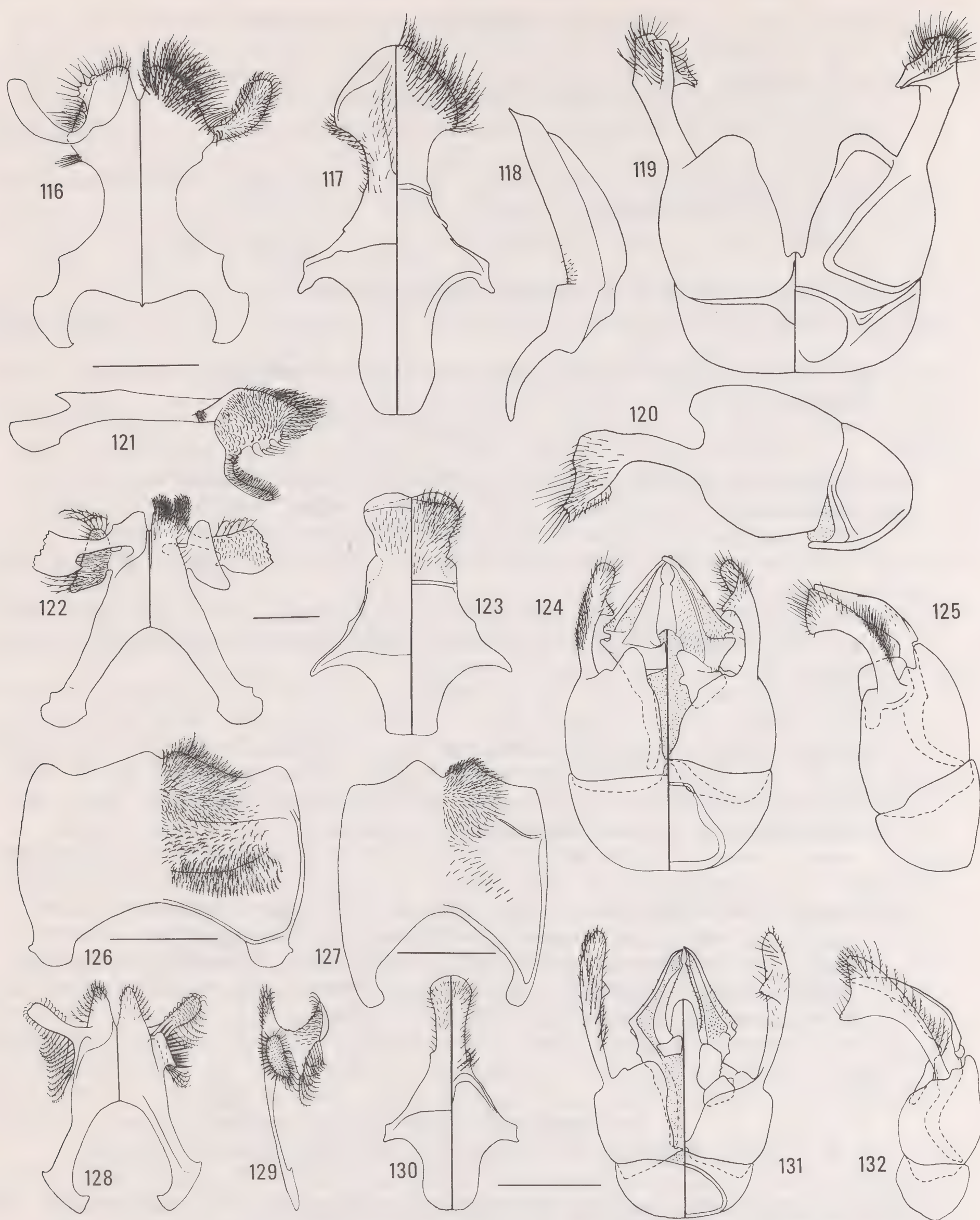
1. With strong, pale apical tergal hair bands; male with deformed hind and middle basitarsi and inner hind tibial spur.
-----Metasamba
- Without metasomal hair bands; legs of male not deformed (hind basitarsus sometimes inflated).
-----2
2. Mandible of female tridentate (male unknown).
-----Haplosamba
- Mandible of female bidentate (inner tooth sometimes reduced to a shoulder).
-----3
3. Propodeal triangle strongly differentiated, basal zone (and laterally entire length of triangle) with short longitudinal rugae; hind basitarsus of male strongly inflated, wider than tibia.
-----Haplomelitta s. str.
- Propodeal triangle differentiated only by weak lines, without rugae on basal zone; hind basitarsus of male slender, much narrower than tibia.
-----4
4. Second submarginal cell about as long as first; first recurrent and first transverse cubital veins usually well separated; basal vein interstitial with cu-v or nearly so; sternum VI of male with two pairs of pedunculate membranous lobes.
-----Atrosamba
- Second submarginal cell distinctly shorter than first; first recurrent and first transverse cubital veins close together, interstitial or the former on either side of the latter; basal vein much basad of cu-v; sternum VI of male with one pair of pedunculate membranous lobes and one pair of hairy areas.
-----Prosamba

Prosamba Michener new subgenus
(Figs. 107, 108, 116, 121, 147, 148)

Type species: Haplomelitta (Prosamba) griseonigra new species.

Diagnosis. Rather small, dark, robust, without metasomal hair bands, with paraglossa, with long hairs on basal segments of maxillary palpus, and with only one pair of membranous lateroapical processes on sternum VII of male.

Description. a. Vertex feebly convex seen from front. Eyes weakly converging below in female, strongly so in male. b. Clypeus of female convex, without median ridge. c. Paraglossa distinct, small,



Figures 116-132. Sambini, males. 116, 117, *Sterna* VII and VIII (dorsal and ventral), *Haplomelitta* (*Prosamba*) *griseonigra* n. sp. 118, Lateral view of penis valve of same. 119, 120, Genitalia (except penis valves and penis) of same (dorsal, ventral, and lateral). [Genitalia of the only male of *H. griseonigra* had been dismembered by someone and could not be illustrated intact.] 121, 122, Sternum VII (lateral, dorsal and ventral), *H. (Atrosamba) atra* n. sp. 123, Sternum VIII of same (dorsal and ventral). 124, 125, Genitalia of same (dorsal, ventral, and

tapering distally. First two segments of maxillary palpus with long hairs (Fig. 107). d. Flagellar segment 1 of female fully three times as long as broad, as long as 2-4 together; all flagellar segments except 1 and 10 broader than long. e. Flagellar segment 1 of male less than three times as long as broad, about as long as next 2 to 3 segments; segments 2 and 3 broader than long, 4 to 10 about as long as broad. f. Basal vein nearly straight, nearly four times as long as first abscissa of Rs, considerably basal to cu-v. g. Stigma tapering into vein R1 so that any measurement of stigmal length is arbitrary. Second submarginal cell distinctly shorter than first. First recurrent vein interstitial with or on either side of first transverse cubital. h. Jugal lobe of hind wing one third as long as vannal lobe. i. Propodeal triangle weakly defined, without rugae. j. Middle tibial spur in both sexes slender, only weakly curved. k. Middle basitarsus of both sexes broad near base and tapering to apex; hind basitarsus of male flattened, largely parallel-sided but narrowed at base and tapering at narrow apex, that of female parallel-sided but tapering in distal third to narrowly truncate apex, only an obtuse angle and no projection above base of segment 2. l. Terga without apical hair bands; margins of terga I-IV in female, I-VI in male broadly depressed and impunctate. m. Sternum VII of male with one pair of membranous lateroapical processes and a pair of lateroapical hairy areas.

Comments. So far as known, this subgenus contains only a single species from the Namaqualand area of Cape Province, described in Appendix II. It is rather small, dark, and has the same robust form as Atrosamba and Metasamba.

Etymology. Pro, a prefix indicating before, plus Samba, the name of a related taxon.

Atrosamba Michener new subgenus
(Figs. 109, 110, 122-126, 147, 148)

Type species: Haplomelitta (Atrosamba) atra new species.

Diagnosis. Large, robust, dark forms without metasomal fasciae; depressed marginal zones of terga narrow and ill-defined; hind basitarsus in both sexes with apical spine projecting above base of segment 2.

Description. a. Vertex approximately straight seen from front. Eyes parallel in female, converging below in male. b. Clypeus of female convex, without median ridge. Inner subapical mandibular tooth very small, often worn so that it seems to be a shoulder rather than a distinct tooth. c. Paraglossa absent or apparently so. d. Flagellar segment 1 of female about 2.5 times as long as broad, as long as next 2.3 flagellar segments together; flagellar segment 2 broader than long,

lateral). 126, Sternum VI of same (ventral). 127, Sternum VI of H. (Haplomelitta) ogilviei (Cockerell). 128, 129, Sternum VII of same (dorsal, ventral and lateral). 130, Sternum VIII of same (dorsal and ventral). 131, 132, Genitalia of same (dorsal, ventral and lateral). Scale lines = 0.5 mm; scale is the same for all figures of any one species except for Figures 126 and 127.

3-9 about as long as broad. e. Flagellar segment 1 of male about 1.5 times as long as broad, subequal in length to segment 3; segment 2 broader than long but all other flagellar segments longer than broad. f. Basal vein distinctly curved basally, about 3.5 times as long as first abscissa Rs, approximately interstitial with cu-v. g. Stigma tapering into vein R₁; second submarginal cell scarcely shorter than first; first recurrent vein substantially distal to first transverse cubital. h. Jugal lobe of hind wing about half as long as vannal lobe. i. Propodeal triangle weakly defined, without rugae. j. Middle tibial spur of female rather robust, strongly curved apically, of male slender and weakly curved. k. Middle and hind basitarsi of both sexes flattened, approximately parallel-sided, apex of each subtruncate, produced distally as strong hairy spine or angle above base of segment 2; female with these spines acute, that of middle basitarsus ending at about middle of segment 2, of hind nearly reaching apex of segment 2; middle basitarsus of male with only slightly acute apical angle, hind basitarsus with acute but blunt apical process reaching level of base of segment 2. l. Terga without apical hair bands; margins of terga 1-4 in female, 1-6 in male, rather narrowly depressed, weakly so mid-dorsally, and impunctate. m. Seventh sternum of male with two pairs of pedunculate lateroapical processes (Fig. 122) (apices of longer pair probably torn off in the only male specimen).

Comments. This subgenus contains a single large, robust, black species from western Cape Province. It is described in Appendix II.

Etymology. Atro-, black, plus Samba, the name of a related taxon.

Haplosamba Michener new subgenus (Fig. 147)

Type species: Haplomelitta (Haplosamba) tridentata new species.

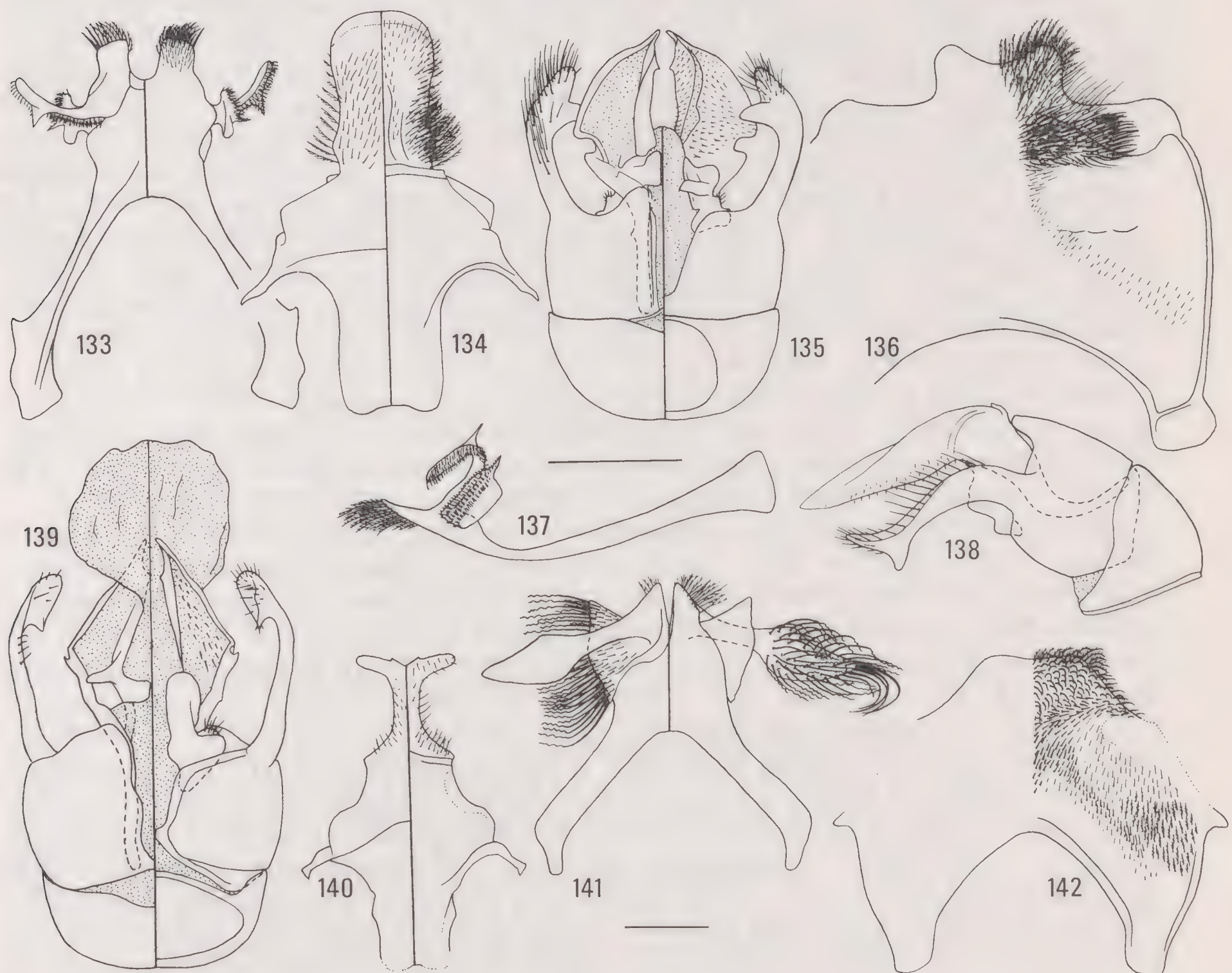
Diagnosis. Shining, coarsely punctate, with partially red, non-fasciate metasoma like Haplomelitta s. str.; mandible tridentate in the female; propodeal triangle weakly defined. This subgenus is known only from the female.

Description. a. Vertex weakly concave seen from front. Eyes diverging below. b. Clypeus convex, without median ridge. Apex of mandibular pollex bidentate so that mandible is conspicuously tridentate. c. Paraglossa absent or apparently so. [Mouthparts generally as illustrated for Haplomelitta (Figs. 111, 112) but galeal comb strong (15 bristles); posterior margin of stipes straight, anterior and posterior margins straight; ligular arms long, arising at base of prementum and ending nearer apex than in Haplomelitta.] d. Flagellar segment 1 about twice as long as broad, as long as next two together; all flagellar segments except 1 and 10 broader than long but 7-9 scarcely so. f. Basal vein curved near base, about three times as long as first abscissa of Rs, considerably distal to cu-v. g. As in Prosamba but in the available specimen first recurrent a short distance distal to first transverse cubital. h. Jugal lobe of hind wing over two fifths as long as vannal lobe. i. Propodeal triangle weakly defined, without rugae. j. Middle tibial spur rather thick (as thick as longer hind spurs) but only moderately curved apically. k. Middle basitarsus with margins convex so that segment is widest medially; hind basitarsus narrower than

middle, parallel-sided; apices of both truncate with a right angular or slightly obtuse angle above base of segment 2. 1. Terga without apical hair bands; margins of terga 1-4 rather broadly and distinctly depressed, impunctate.

Comments. This subgenus contains only a single known species from Namaqualand, Cape Province, described in Appendix II. It is superficially like *H. (Haplomelitta) ogilviei*, having the same rather slender form and partly red metasoma.

Etymology. *Haplo-*, single or simple, appropriate because of the generic name *Haplomelitta*, plus *Samba*, the name of a related taxon.



Figures 133-142. Sambini, males. 133-135, Sterna VII, VIII, and genitalia, *Haplomelitta (Metasamba) fasciata* n. sp. (dorsal and ventral). 136, Sternum VI of same (ventral). 137, Sternum VII of same (lateral). 138, 139, Genitalia of *Samba calcarata* Friese (lateral, dorsal, and ventral). 140, 141, Sterna VIII and VII of same (dorsal and ventral). 142, Sternum VI of same (ventral), reconstructed posterolaterally where lines are dotted because the sclerite was broken. Scale lines = 0.5 mm; scale is the same for all figures of either species.

Subgenus *Haplomelitta* Cockerell s. str.
(Figs. 111, 112, 127-132, 143, 147, 148)

Haplomelitta Cockerell, 1934, p. 446.

Type species: *Rhinochaetula ogilviei* Cockerell, 1932, by original designation.

Diagnosis. Slender, coarsely punctate, sparsely hairy forms superficially similar to *Haplosamba*, from which it differs by the bidentate rather than tridentate mandibles and the grotesquely modified first metasomal sternum of the female.

Description. a. Vertex of female gently concave seen from front; of male straight, slightly elevated in area of ocelli. Eyes parallel in female, converging below in male. b. Clypeus of female convex, without median ridge. c. Paraglossa absent or apparently so. d. Flagellar segment 1 of female over twice as long as wide, as long as next two segments together; segments 2 to 9 much broader than long. e. Flagellar segment 1 of male about 1.5 times as long as wide, as long as next 1.5 segments; segments 2 and 3 broader than long, subsequent segments grading to 6 to 10 which are as long as broad. f. Basal vein gently curved basally, about three times as long as first abscissa of Rs, slightly distal to cu-v or essentially interstitial. g. Second submarginal cell distinctly shorter than first. First recurrent vein a short distance distal to first transverse cubital. h. Jugal lobe of hind wing about one third as long as vannal lobe. i. Propodeal triangle defined by strong lines, with longitudinal rugae extending all the way across lateral parts of triangle and across anterior half medially. j. Middle tibial spur robust, especially in female, apex strongly hooked in female. k. Middle and hind basitarsi of female flattened; middle basitarsus broader than hind, its margins convex so that segment is widest near middle, apex with right angle above base of segment 2; hind basitarsus parallel-sided, apex truncate with acute projection extending over base of segment 2. Middle basitarsus of male slender, nearly parallel-sided, nearly as long as tibia, obliquely truncate at apex. Hind basitarsus of male inflated, slightly broader than tibia, rounded at apex, nearly as long as tibia. l. Terga without apical hair bands; posterior margins of terga I-IV of females and I-VI of male depressed, shining, impunctate. Metasomal sternum I of female with a broad, deep, apical emargination in which there is a slender, posteriorly directed, median process, split and down-curved as small flaps at apex (see illustrations in Rozen, 1974). m. Sternum VII of male with one pair of slender lateroapical lobes and one pair of broad sessile lobes, larger hairs of both coarsely plumose or pectinate.

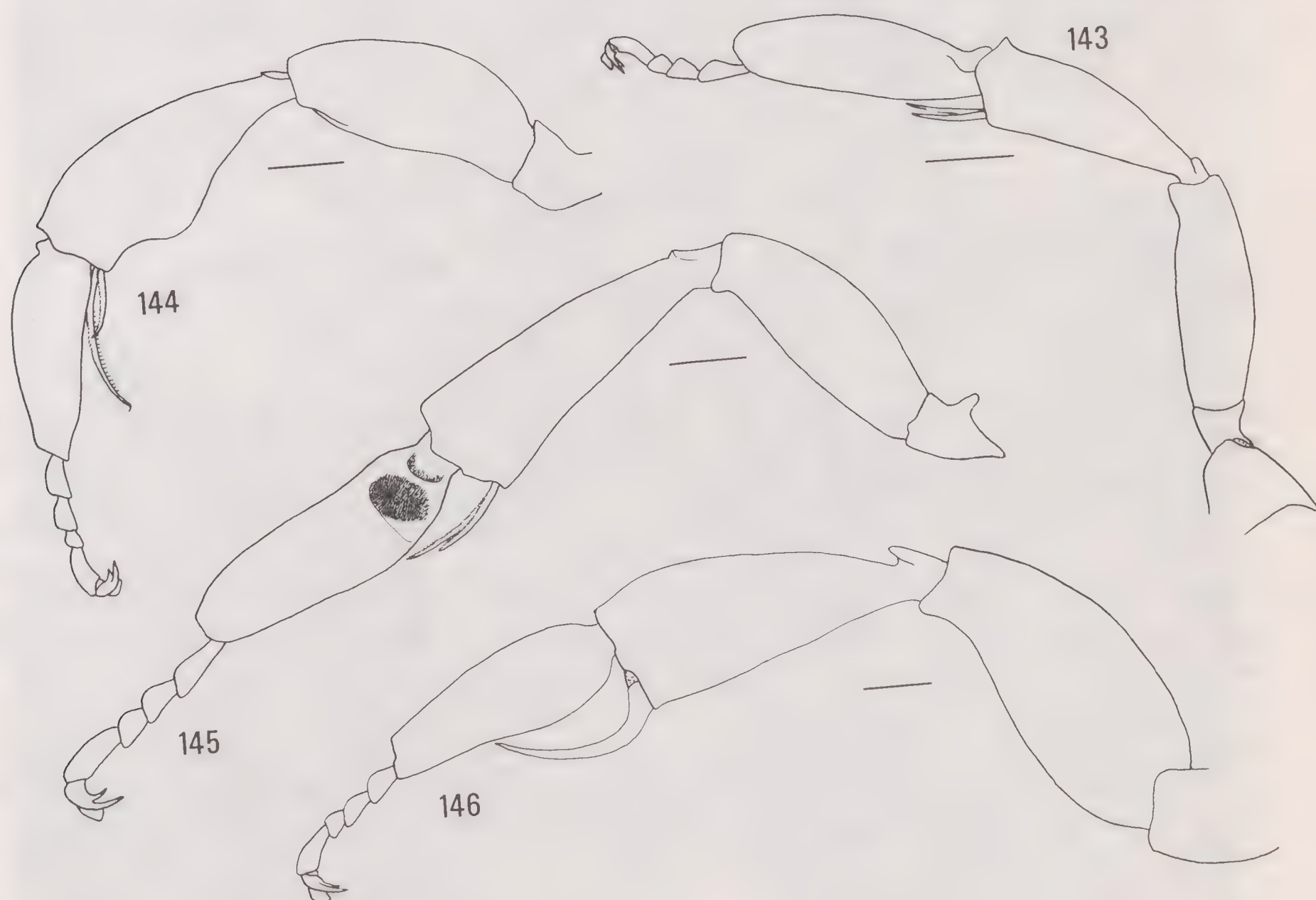
Comments. As here defined this subgenus includes only a single species from western Cape Province, South Africa. It is rather slender, with the metasoma largely red. Cockerell (1934) included *Capicola diversipes* Cockerell (1932), described from a single male, in *Haplomelitta*. I have not seen this species; it could be the male of the form here placed in *Haplosamba* but seems too small; more material and associated sexes are needed to determine the subgeneric status of *Haplomelitta diversipes* (Cockerell). Rozen (1974) described nests of *H. (H.) ogilviei*.

Metasamba Michener new subgenus
(Figs. 133-138, 144, 147, 148)

Type species: Haplomelitta (Metasamba) fasciata new species.

Diagnosis. Rather small, robust, pale haired, with apical hair bands on metasomal terga arising from depressed, punctate marginal zones.

Description. a. Vertex faintly convex seen from front. Eyes weakly converging below in female, strongly so in male. b. Clypeus of female with longitudinal median ridge. c. Paraglossa absent or apparently so. d. Flagellar segment 1 of female about 1.5 times as long as broad, as long as next 1.5 segments; all flagellar segments except 1 and 10 broader than long. e. Flagellar segments 1 and 2 of male slightly longer than broad, remaining segments all longer than broad. f. Basal vein weakly curved, two (in male) to nearly three times as long as first abscissa of Rs, slightly distal to cu-v. g. Second submarginal cell shorter than first. First recurrent vein substantially distal to first transverse cubital. h. Jugal lobe of hind wing two fifths to nearly half as long as vannal lobe. i. Propodeal triangle weakly defined, without rugae. j. Middle tibial spur in both sexes robust, strongly curved apically. Hind tibia of male thickened beyond



Figures 143-146. Hind legs of Sambini. 143, Haplomelitta (Haplomelitta) ogilviei (Cockerell), male. 144, H. (Metasamba) fasciata n. sp., male. 145, 146, Samba calcarata Friese, male and female. Scale lines = 0.5 mm.

middle (Fig. 144) with area of erect white hair on inner side near apex. Inner hind tibial spur of male long, slender, about three fourths as long as basitarsus, apparently twisted so that it is curved downward (normal spurs are curved upward), with sharp bend upward at extreme apex, and with teeth numerous, very fine, some nearly as long as spur diameter, and on lower margin of spur (because of twisting of the spur axis). k. Middle basitarsus of female flat, margins convex so that segment is widest medially, narrowed at each end, apex truncate, segment 2 arising from lower part of truncation, upper part forming slightly obtuse angle; hind basitarsus similar but margins less convex, straight and parallel from near base to apical third which tapers to truncation, angle above base of segment 2 acute but not much produced apicad. Middle basitarsus of male broadest at large, right angular premedian tooth on anterior margin, tapering to obliquely truncate apex. Hind basitarsus of male flat but somewhat inflated, shape shown in Figure 144. l. Terga I-IV of female, I-VI of male, with moderately broad depressed apical margins which are rather finely punctate and give rise to white apical hair bands. m. Sternum VII of male with two pairs of lateroapical processes, one short, pedunculate, the other long, slender, strap-like with a postmedian, anterior projecting angle.

Comments. This subgenus contains only a single species, recently collected in Namibia (South West Africa). Its robust body is suggestive of Prosamba and Atrosamba.

Etymology. Meta-, a prefix meaning along with or after, plus Samba, the name of a related taxon.

Genus Samba Friese
(Figs. 113-115, 139-142, 145-148)

Samba Friese, 1908, p. 568.

Type species: Samba calcarata Friese, 1908 (monobasic).

Diagnosis. Female with only one hind tibial spur; head extraordinarily short and broad, vertex concave seen from front, shortest distance between eyes of female greater than length of eye. Male with hind basitarsus swollen with large hairy pit on outer side near base.

Description. a. Body of moderate size (9-10 mm long), not densely hairy. b. Head much broader than long, as wide as thorax in male, wider than thorax in female; clypeus over three times as wide as long, not overhanging base of labrum; minimum distance between eyes much longer than length of eye in female, about equal to length of eye in male; vertex distinctly concave seen from front. c, d. Labrum of both sexes over four times as wide as long with very strong, sharp, transverse premedian ridge which is elevated to form tooth on each side of small median concavity; surface basal to ridge flat, smooth, shining,

Figure 147. Faces of Sambini. Top row, left to right, Haplomelitta (Prosamba) griseonigra n. sp., female, male; H. (Haplomelitta) ogilviei (Cockerell), female. Second row, H. (Atrosamba) atra n. sp., female, male. Third row, H. (Metasamba) fasciata n. sp., female, male. Bottom row, left to right, Samba calcarata Friese, female, male, Haplomelitta (Haplosamba) tridentata n. sp., female holotype. Scale line = 0.5 mm. →



hairless; distal surface of ridge also shining and hairless, surface beyond ridge punctate, with some hairs basal to long marginal bristles. e. Flagellar segment 1 of male a little longer than broad, 2 broader than long, others mostly about 1.5 times as long as broad. f. Flagellar segments of female mostly about as long as broad or a little broader than long, but segments 1 and 10 much longer than broad. g. Maxillary blade twice as long as broad, apex broadly rounded with a few long hairs; palpus extending well beyond blade. h. Galeal comb well developed; flange on posterior side of stipes extending full length of stipes. i. Prementum slender; ligular arm arising near base of prementum, ending as blunt point rather near to apex. Mentum not sclerotized, distal end bent strongly anteriorly. j. Glossa rather attenuate, much exceeding labial palpi. k. Paraglossa not recognizable, perhaps a robust, tapering, almost hairless structure at the end of the suspensorium. l. Segments of labial palpus with apices not laterally produced. m. Basal vein nearly three times as long as first abscissa of Rs, curved especially basally, interstitial with or slightly distal to cu-v. n. Stigma of moderate size, more than half as long as costal margin of marginal cell; vein r arising at middle of stigma; margins of stigma basal to vein r converging basally; length from base to base of vein r about twice the greatest width of stigma. o. Prestigma about one third as long as stigma. First recurrent vein well beyond first transverse cubital. p. Apex of marginal cell bluntly pointed, separated from costal margin of wing by two or three vein widths. q. Jugal lobe of hind wing about one third as long as vannal lobe. r. Propodeal triangle smooth, shining, defined only by lack of pubescence, surface as seen in profile in same plane as rest of propodeum, at about a 45 degree angle to main axis of body. s. Basitibial plate well defined and strongly elevated in both sexes, surface hairy. t. Scopal hairs short, simple, much shorter plumose hairs beneath them in some areas but tibial surface easily visible; dense fine yellow hairs, very different from those of scopa, on under side of basitarsus; tibia with scopa-like hairs (sparser on upper and lower than on outer surfaces) except for zone of keirotichia over half as wide as tibia. u. Female with only one hind tibial spur which is large, sickle-shaped, with a thickened base, and with smooth margins; middle tibial spur thickened, apical part curved, margins densely microserrate ("ciliate"). Male with tibial spurs only gently curved, rather slender, minutely microserrate. v. Middle and hind basitarsi of female flat, margins convex so that mid basitarsus is widest medially, hind near basal third, both roughly three times as long as broad, somewhat narrower than tibiae, each rather narrowly subtruncate apically and giving rise to segment 2 near lower apical angle; upper apical angle of middle basitarsus obtuse, of hind slightly produced but blunt. w. Middle basitarsus of male somewhat flattened, slightly tapering toward obliquely truncate apex. Hind basitarsus of male swollen, parallel-sided except narrowed at each end, a large pit lined with white hairs near base of outer side, apex subtruncate, segment 2 arising from lower part of apex. x. Distitarsi swollen, much broader than preceding segments. y. Claws cleft to middle or beyond middle, inner ramus shorter than outer. z. Metasomal terga I-IV of female and I-V of male with broad, depressed, impunctate, apical zones which are well defined across each tergum, narrow sublaterally but broad medially, so that each tergum has a broadly procurved transverse line across it which mid-dorsally is about midway

between gradulus and posterior tergal margin. aa. Terga without hair bands. bb. Pygidial plate of female strongly elevated, well defined, with abruptly elevated longitudinal median zone. cc. Pygidial plate of male absent. dd. Sixth sternum of male with apical truncation over one fourth as wide as sternal width. ee. Seventh sternum of male deeply, medially notched at apex, with two pairs of membranous lateroapical lobes, one sessile, the other pedunculate, most of hairs on both with apices wavy. ff. Eighth sternum with strong slender apical process, dividing apically into laterally directed processes. gg. Gonostylus of male longer than gonocoxite, well differentiated at base, slender, but enlarged and angulate at apex, hairs few, short.

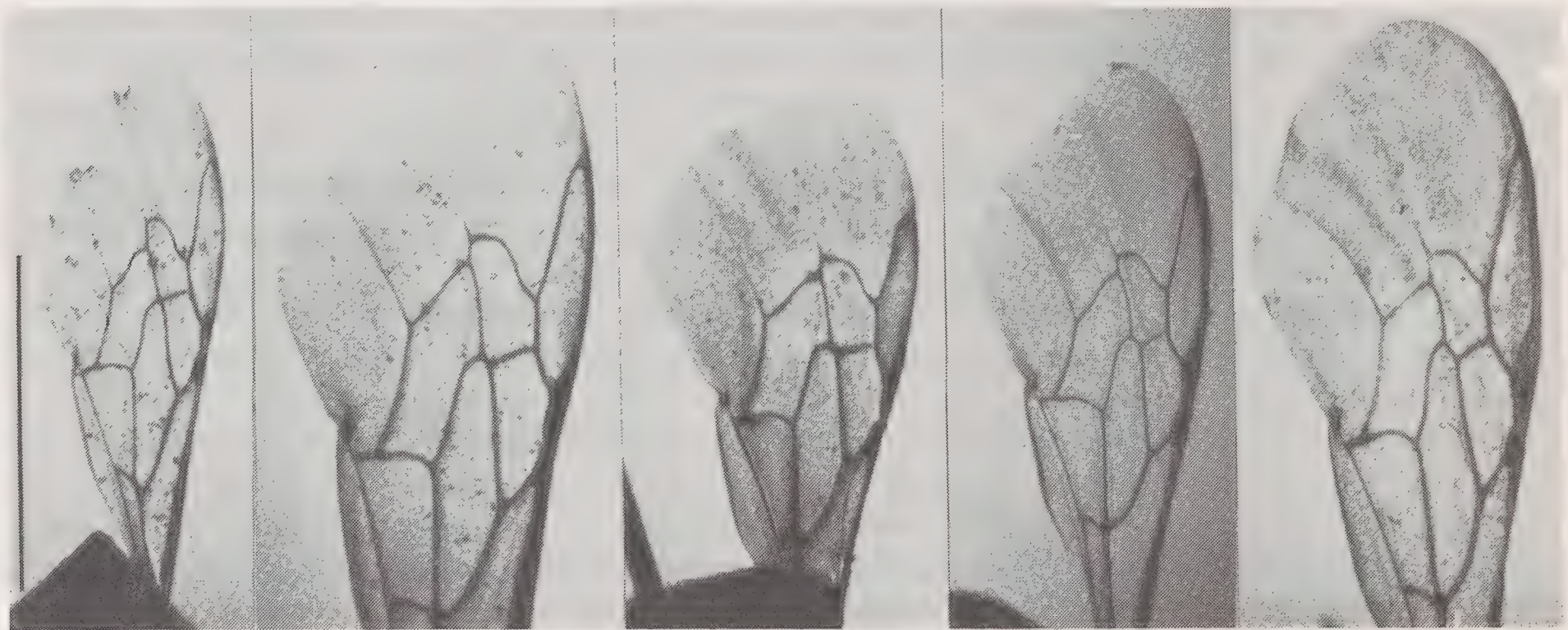


Figure 148. Forewings of Sambini. Left to right, Haplomelitta (Prosamba) griseonigra n. sp., H. (Atrosamba) atra n. sp., H. (Haplomelitta) ogilviei (Cockerell), H. (Metasamba) fasciata n. sp., and Samba calcarata Friese. Scale line = 0.5 mm.

Comments. This genus is known from a single species, Samba calcarata Friese, known only from Kenya and Tanzania. As is apparent from Figures 1 and 2, as well as the above description, it has many unusual features. It clearly belongs in a genus of its own.

Dasypodini new tribe

This large Holarctic and African tribe can be recognized by the characters indicated in the key to tribes and in Table 2. Its synapomorphies are also indicated in Figures 1 and 2.

Key to the Genera of the Tribe Dasypodini

1. Yellow integumental markings present at least on face and legs; stigma large, slightly shorter to slightly longer than costal mar-

gin of marginal cell; prepygidial and pygidial fimbriae of female absent (Central Asian deserts).

-----Eremaphanta

- Yellow integumental markings absent (except sometimes on clypeus of male only); stigma not enlarged, about half as long as costal margin of marginal cell; prepygidial and pygidial fimbriae of female well developed, or the former represented by a hair band similar to those of preceding terga.

-----2

2. Basitibial plate absent; profile of propodeum all more or less in one plane; galeal comb absent or nearly so; male gonostylus well differentiated, nearly always deeply bifid (Palearctic Region).

-----Dasypoda

- Basitibial plate of female and nearly all males present, rarely defined only along posterior margin; base of propodeum more nearly horizontal than rest in profile [except in some Hesperapis (Carinapis)]; galeal comb present; male gonostylus broad, fully fused to gonocoxite, not bifid but often with short inner process or lobe.

-----3

3. Pygidial plate of female with longitudinal median elevated area or at least ridges representing edges of such an area; male gonostylus without inner lobe (South Africa).

-----Capicola

- Pygidial plate of female without longitudinal median elevated or differentiated area (sometimes with triangular basal area); male gonostylus with inner lobe usually bearing long, coarse, branched bristles or hairs (North America).

-----4

4. Mesoscutum as long as or longer than minimum intertegular distance; front tibia with series of five or more robust, apical and posteroapical, amber spines on outer surface.

-----Xeralictoides

- Mesoscutum considerably shorter than minimum intertegular distance; front tibia without such spines.

-----Hesperapis

Genus Dasypoda Latreille (Figs. 149-158)

Dasypoda Latreille, 1802, p. 424.

Type species: Andrena hirtipes Fabricius, 1793, designated by Blanchard, 1840, p. 414. [Melitta swammerdamiella Kirby, 1802, designated as the type species by Curtis (1831, p. 367) was not originally included in Dasypoda but is a synonym of A. hirtipes.]

Podasys Rafinesque, 1815, p. 123.

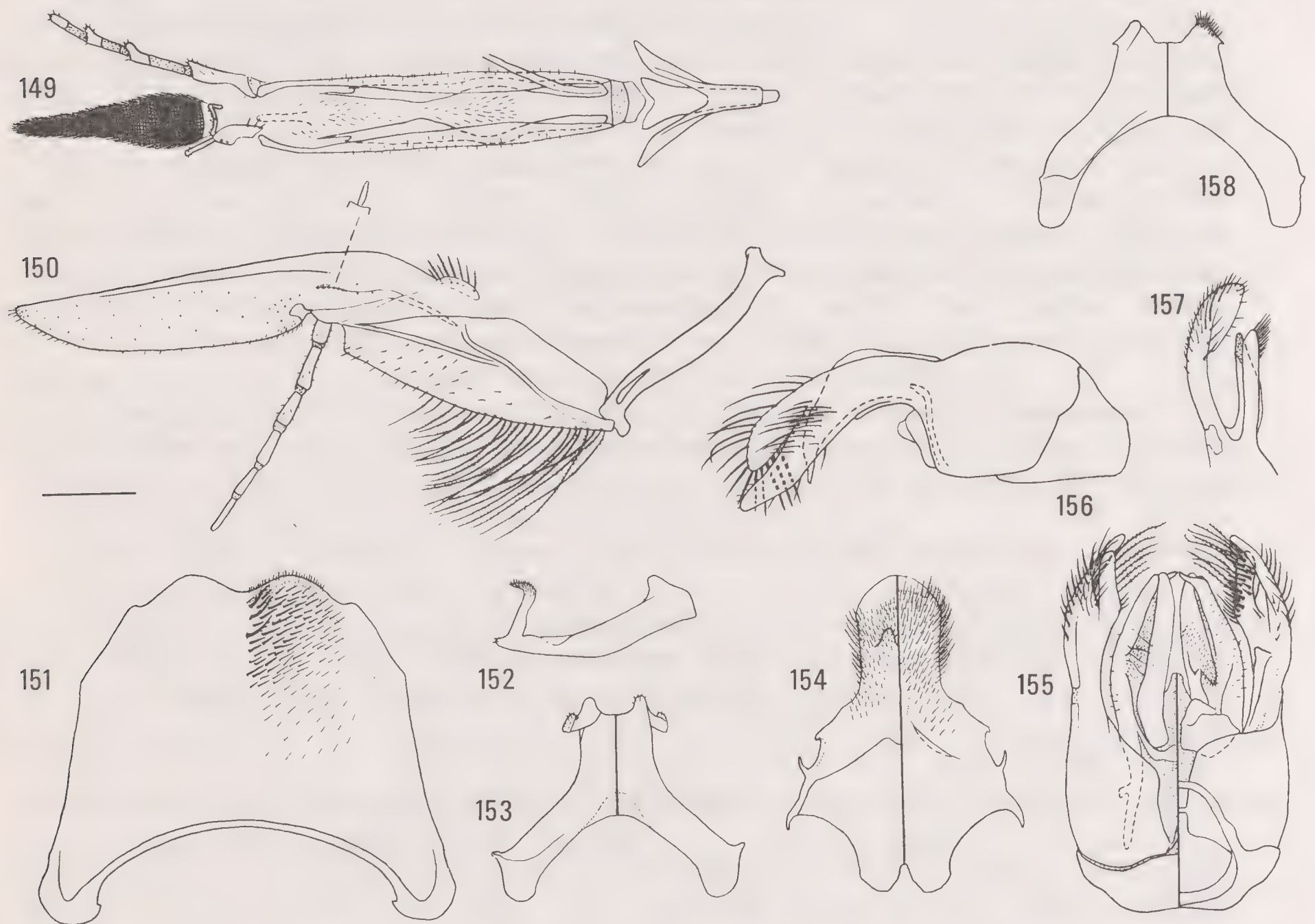
Type species: Andrena hirtipes Fabricius, 1793 (Podasys was proposed unnecessarily to replace Dasypoda; the type species is therefore automatically the same as that of Dasypoda.)

Diagnosis. Large bees without yellow integumental markings, with abundant long hairs. Galeal comb absent or nearly so; basitibial plate absent in both sexes; propodeal profile slanting, without subhorizontal basal zone.

Description. a. Body rather large (10-17 mm long), elongate, with abundant long hair; yellow integumental markings absent. b. Head round to broader than long, distinctly narrower than thorax; vertex convex as seen from front. c. Labrum of male less than three to over four times as wide as long, with basal half smooth, shining, convex to nearly flat, sometimes with low ridge separating it from hairy, punctate distal zone. d. Labrum of female similar in shape to that of male, with elevated, bare, basal area separated by strong ridge from hairy distal zone. e. Flagellar segments of male all or mostly longer than broad, segment 1 often longest. f. Flagellar segments of female mostly broader than long or slightly longer than broad but segment 1, which is much longer than any other, much longer than broad and narrowed toward base. g. Maxillary blade over four times as long as broad, nearly parallel-sided except apically; galeal fringe insignificant; maxillary palpus not attaining apex of galea. h. Galeal comb absent or reduced to a few minute, widely separated bristles. i. Prementum long and slender, lateral margins curled so as to largely or partially hide ligular arms which arise near base of prementum and end at about four fifths of distance from base to apex. j. Glossa tapering but not attenuate at apex. k. Paraglossa minute, hairless or nearly so. l. Labial palpus not or scarcely reaching apex of glossa, segments 2 and 3 subcylindrical, apices not produced laterally. m. Basal vein less than twice to over three times as long as first abscissa of Rs, nearly straight, distal to cu-v. n. Stigma slender, less than half as long as costal margin of marginal cell; vein r joining stigma at distal third; margins of stigma basal to vein r only slightly converging basally. o. Prestigma nearly to more than two thirds as long as stigma. p. Apex of marginal cell narrowly rounded, separated from costal wing margin by two or three vein widths. q. Jugal lobe of hind wing less than half as long as vannal lobe, measured from wing base. r. Propodeal triangle rather large, dull, not steeply sloping, flat seen in profile (there being no basal zone more nearly horizontal than rest). s. Basitibial plate absent in both sexes. t. Scopa consisting of dense, long, minutely barbed hairs on both inner and outer surfaces of hind tibiae and basitarsi; keirotichia absent. u. Mid and hind tibial spurs nearly straight, their margins minutely and densely microserrate ("ciliate"). v, w. Mid and hind basitarsi of female long, slender, tapering or in males sometimes parallel-sided, giving rise to segment 2 in middle of the narrow apex. x. Distitarsi not swollen, often no broader than preceding segments. y. Claws cleft about to middle, inner ramus shorter in female than in male. z. Metasomal terga I to IV of females and I to V of males with broad, depressed, impunctate, often translucent margins and usually with apical or preapical pale hair bands which partly cover depressed marginal areas. aa. Prepygidial and pygidial fimbriae of female dense. bb. Pygidial plate of female well

defined, smooth but often dull, notched at apex, without median elevated area. cc. Pygidial plate of male absent. dd. Sternum VI of male strongly bilobed, the lobes with short hairs. ee. Sternum VII with rather reduced disc, apex bilobed, each lobe with slender, dorsally projecting lateroapical lobe that is hairy distally [lateroapical lobe greatly reduced in some species, e.g., *D. argentata* (Panzer)]. ff. Sternum VIII with broad apical process which is not truncate. gg. Gonostylus usually as long as or longer than gonocoxite, fused to gonocoxite dorsally but area of separation more or less clear; gonostylus usually bifid, sometimes to base, and in species such as *D. argentata* Panzer apparently deeply trifid although one of the three distal processes could be of gonocoxal origin.

Comments. This is a well-known genus of rather large, conspicuous bees that is not closely related to any other genus. The following characters are probably apomorphies, for they do not occur in any of the related genera, nor in genera of related subfamilies and families: e, h, s, and t.



Figures 149-158. *Dasypoda*, males. 149-156, *D. hirtipes* (Fabricius). 149, Anterior view of labium. 150, Inner view of maxilla. 151, Sternum VI (ventral). 152, 153, Sternum VII (lateral, dorsal, and ventral). 154, Sternum VIII (dorsal and ventral). 155, 156, Genitalia (dorsal, ventral, and lateral). 157, Gonostylar area (dorsal) of *D. argentata* Panzer. 158, Sternum VII (dorsal and ventral) of same. Scale line = 0.5 mm and is applicable to all figures.

The lack of basitibial plates in females (character s) is a surprising feature for such plates are present in most bees that burrow in the ground, presumably playing a role in locomotion through the burrows. Lack of such plates among burrowing bees is largely limited to the genera Dasypoda and Colletes.

Dasypoda is widespread in the Palearctic Region, ranging from Portugal to Japan. The distribution includes most of Europe and North Africa, and in Asia extends south to India (according to Quilis, 1928). The genus is particularly well represented in the Mediterranean Basin. A review of the west-Palearctic species was given by Warncke (1973), while the Spanish species were revised by Quilis (1928). The genus has long been properly recognized, for example by Dalla Torre (1896), and there is no need to list the species. The larva is described by Rozen and McGinley (1974); the nesting biology by Malyshev (1927) and Lind (1968).

Genus Eremaphanta Popov (Figs. 159-167)

Diagnosis. Small bees, commonly with extensive yellow markings but at least with yellow areas on face and legs; stigma large, transparent, approximately as long as costal margin of marginal cell and more than three times as long as prestigma; prepygidial and pygidial fimbriae of female absent.

Description. a. Minute (4-6.5 mm long), rather slender, sparsely hairy; yellow integumental markings extensive or limited to mandible, labrum, clypeus and legs. b. Head transverse to elongate, in latter case distinctly narrower than thorax; vertex convex as seen from front. c, d. Labrum less than three to nearly four times as wide as long, convex, smooth and shining except for hairy apical margin. e, f. Flagellar segments except the last broader than long, or in some males slightly longer than broad; segment 1 not strikingly different in length from subsequent segments. g. Maxillary blade three or somewhat more times as long as broad, tapering to narrowly rounded to almost pointed apex; galeal fringe present, hairs rather short to moderately long; maxillary palpus extending beyond apex of galea. h. Galeal comb present. Stipes with large concavity in distal two thirds of posterior margin, this concavity with short hairs, without teeth such as are found in long tongued bees. i. Prementum robust, ligular arms arising near base [dispar (Morawitz)] or beyond end of basal fourth [fasciata Popov], ending one third to one fourth of length of prementum from apex. j. Glossa tapering, attenuate at apex at least in E. dispar (Morawitz). k. Paraglossa minute, partly hairless. l. Labial palpus equal to or exceeding glossa, in E. fasciata Popov but not in E. dispar (Morawitz) segments 2 and 3 ending obliquely and produced laterally. m. Basal vein one to two times as long as first abscissa of Rs, curved, distad to cu-v. n. Stigma large, transparent, slightly shorter than to slightly longer than costal margin of marginal cell, vein r joining stigma near middle, margins of stigma basal to vein r converging basally. o. Prestigma less than one third as long as stigma. p. Apex of marginal cell pointed, on or very near wing margin. q. Jugal lobe of hind wing over two thirds to over three fourths as long as vannal lobe. r. Propodeal triangle large, minutely sculptured, shining or partly dull, nearly all horizontal; propodeum in profile about half horizontal and

half vertical, one surface rounding onto the other. s. Basitibial plate present in both sexes, rounded, shining. t. Scopa sparse, consisting of long, simple hairs, largely confined to outer surfaces of hind tibia and basitarsus; keirotichia occupying undefined, longitudinal median band on inner tibial surface. u. Mid and hind tibial spurs nearly straight, their margins minutely serrate. v, w. Mid and hind basitarsi somewhat flattened in female, scarcely so in male, slightly tapering, giving rise to segment 2 in middle of apical margin. x. Distitarsi not noticeably swollen although somewhat broader than preceding segments. y. Claws of female with inner tooth simple or absent; of male, at least in E. dispar (Morawitz), cleft, inner ramus a little shorter than outer. z. Metasomal terga I-V of females and I-VI of males with depressed, impunctate, transparent, smooth apical margins, relatively narrow on anterior terga and progressively broader posteriorly. aa. Terga with or without apical hair bands. Dense prepygidial and pygidial fimbriae absent. bb. Pygidial plate of female well defined, sometimes [in E. fasciata and dispar (Morawitz)] occupying almost whole dorsal surface of tergum VI. cc. Pygidial plate of male absent. dd. Sternum VI of male bilobed or medially notched [at least in E. dispar (Morawitz)]. ee. Sternum VII with rather large disc which has two, pointed, hairy lobes at apex; lateroapical lobes absent. ff. Sternum VIII with apical process obliquely truncate. gg. Gonostylus simple, about as long as gonocoxite, broadly fused to it.

Comments. This is a genus of minute bees which, by their size and bright coloration, resemble the species of Perdita (Panurginae), Nomioides and Habralictus (Halictidae), and certain groups of Euryglossinae (Colletidae). Popov (1957) was quite correct in saying that Eremaphanta is distinct from Hesperapis, a genus into which I had earlier suggested (Michener, 1944) that Eremaphanta might fall. In 1944 I had not seen specimens of Eremaphanta, and based my suggestion primarily on Popov's (1940) illustrations of the genitalia and hidden sterna, which are similar to those of Hesperapis and doubtless indicate common ancestry. Eremaphanta differs from Hesperapis and other Dasypodini in a series of apomorphic characters as follows: a, h (concavity in posterior margin), n, o, r, t, and aa. Another character, equally distinctive but not known to be apomorphic, is q.

Eremaphanta is known only from arid parts of Central Asia (the Turkmenskaja S.S.R. and the Tadzikskaja S.S.R.).

Key to the Subgenera of Eremaphanta

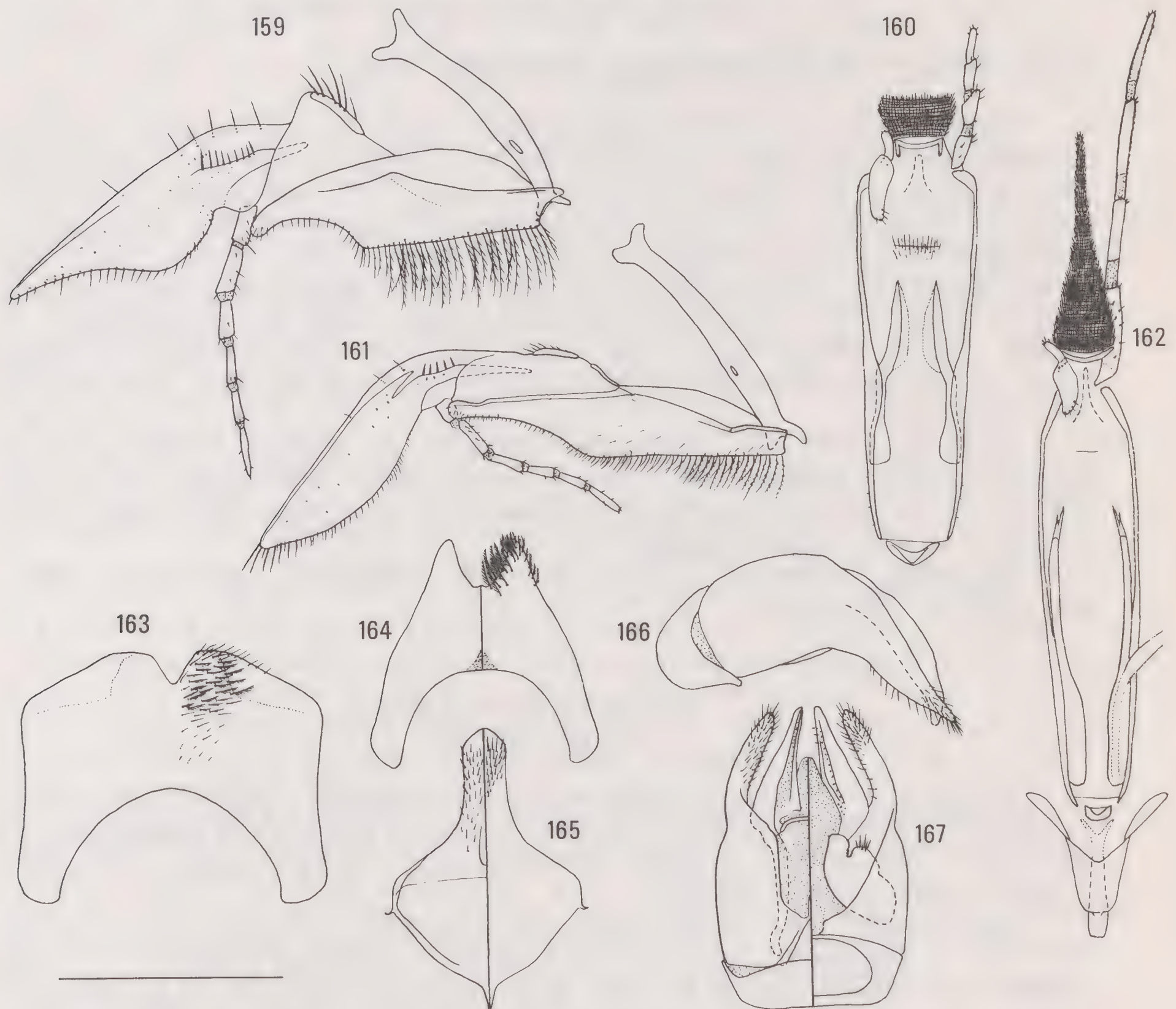
1. Terga without apical hair bands; head broader than long; vertex gently convex, scarcely above level of summits of eyes.
-----Eremaphanta s. str.
- Terga with apical hair bands; head longer than broad; vertex extending far above summits of eyes.
-----Popovapis

Subgenus *Eremaphanta* Popov s. str.

Eremaphanta Popov, 1940, p. 53.

Type species: *Rhophites vitellinus* Morawitz, 1876.

Description. a. Head broader than long, posterior ocelli so placed that, seen from front, they break the convexity of the vertex. b. Body with extensive yellow markings. c. Metasomal terga without apical hair bands. d. Labrum nearly four times as wide as long. e. Maxillary blade less than three times as long as broad. f. Ligular arm



Figures 159-167. *Eremaphanta*. 159, 160, Inner view of maxilla and anterior view of premental area of *E. (Eremaphanta) fasciata* Popov. [Glossa broken off.] 161, 162, Inner view of maxilla and anterior view of labium of *E. (Popovapis) dispar* (Morawitz). 163, Sternum VI, male, of same (ventral). 164, 165, Sterna VII and VIII (dorsal and ventral) of same. 166, 167, Genitalia (lateral, dorsal, and ventral) of same. Scale line = 0.5 mm and is applicable to all figures.

arising over one fourth of distance from base to apex of prementum. g. Labial palpus less than half as long as prementum, segments 2 and 3 ending obliquely and produced laterally. h. Claws of female simple or each with minute tooth on inner surface.

Comments. This subgenus contains E. convolvuli Popov, fasciata Popov, minuta Popov, turcomanica Popov, and vitellina Morawitz. The characters of the mouthparts and claws listed above have been examined by me only for E. fasciata. The other species are placed here on the basis of description and figures (Popov, 1940, 1957).

Popovapis Michener new subgenus

Type species: Rhophites dispar Morawitz, 1892.

Description. a. Head much longer than broad, vertex extending behind ocelli so that, seen from front, summit of vertex is above and behind ocelli. b. Yellow markings limited to mandibles, labrum, clypeus, tegula, legs, and the sometimes reddish yellow metasoma. c. Metasomal terga with distinct apical hair bands. d. Labrum less than three times as wide as long. e. Maxillary blade over three times as long as broad. f. Ligular arm arising near base of prementum. g. Labial palpus longer than prementum, segments more or less cylindrical. h. Claws of female each with large tooth on inner surface representing inner ramus.

Comments. This subgenus contains E. dispar (Morawitz) and zhelochovtsevi Popov. Of these I have seen only the first and the characters of the mouthparts and claws, not described by Popov, may not all apply to the second species.

Etymology. Named in honor of V. B. Popov who described the genus and most of its species.

Genus Capicola Friese (Figs. 168-177)

Diagnosis. Similar to Hesperapis but pygidial plate of female with longitudinal median, defined, usually elevated area; male gonostylus (or possibly distal part of gonocoxite) with inner, basal process or lobe, usually bearing large setae.

Description. a. Small to middle sized (3-11 mm long), with the form of a Halictus; yellow integumental markings absent. b. Head broader than long, about as wide as thorax, vertex convex as seen from front. c. Labrum of male nearly to more than four times as wide as long, basal half smooth, shining, convex, no ridge separating it from distal half which is hairy and punctate. d. Labrum of female similar in shape to that of male; basal area dull to shiny, convex, biconvex, or divided by longitudinal grooves into a series of convexities, or otherwise roughened; distal hairy zone often narrow or limited to margin. e. Flagellar segments of male mostly about as broad as long or longer than broad, segment 2 much broader than long, 1 and 3 often broader than long. f. Flagellar segments of female mostly broader than long or as long as broad, segment 2 distinctly broader than long, 1 broader than long to longer than broad. g. Maxillary blade about four times as long

as broad, shaped about as in Hesperapis pellucida (Fig. 187), more tapering and pointed in C. braunsiana, blunt in C. nanula; galeal fringe insignificant to moderately developed. h. Galeal comb usually large (about 16 spines), only 8 spines in C. nanula; maxillary palpus attaining apex of galea. i. Prementum about as in Hesperapis pellucida (Fig. 186) but ligular arms somewhat shorter, in C. nanula as short as in H. ilicifoliae (Fig. 188). j. Glossa sometimes more tapering and more sharply pointed than in Hesperapis pellucida, or in C. nanula rather blunt. k. Paraglossa minute, with few short apical and subapical hairs. l. Labial palpus attaining (in C. aliciae) or usually surpassing apex of glossa, segments 2 and 3 subcylindrical, apices not produced laterally. m. Basal vein less than to more than twice as long as first abscissa of Rs, gently curved or rather strongly so near base, distal to cu-v. n. Stigma more than half as long as costal margin of marginal cell; vein r joining stigma slightly beyond middle; margins of stigma basal to vein r converging (sometimes only slightly) basally. o. Prestigma less than one third to over one half as long as stigma. p. Apex of marginal cell pointed or narrowly rounded, separated from wing margin by one or two vein widths. q. Jugal lobe of hind wing over half to less than two thirds as long as vannal lobe. r. Propodeal triangle of moderate size to rather short and transverse, minutely roughened and slightly shining to coarsely rugose striate or pitted; propodeum seen in profile with basal zone more horizontal than declivous posterior surface. s. Basitibial plate present in both sexes. t. Scopa consisting of long, simple hairs on outer sides and upper and lower margins of hind tibia and basitarsus; shorter plumose hairs under long hairs along posterior (upper) part of outer surface of tibia, from basitibial plate to apex; inner surfaces of tibia and basitarsus with shorter, finer, denser hairs, those of tibia (keirotichia) blunt at apices and forming a band the length of tibia and over two thirds as wide as tibia. u. Mid and hind tibial spurs strongly curved or not, slender, margins of hind spurs and middle spur of males minutely and densely microserrate, middle spur of female C. nanula similar, of other species with only a few, large, widely separated teeth. v, w. Mid basitarsus of female broadest near base or near middle, often broader than hind basitarsus which is broadest near base or is nearly parallel-sided in C. aliciae and nanula; these basitarsi giving rise to segment 2 near middle of narrow apex. x. Distitarsi not much swollen, not or only moderately broader than preceding segments. y. Claws cleft much less than half way to base, inner ramus a rather short tooth in female, only somewhat shorter than outer ramus in male. z. Metasomal terga I to V of female and I to VI of male with slightly depressed, translucent, marginal zones, those of I to IV of female and most of those of males usually largely covered with apical white hair bands. aa. Prepygidial and pygidial fimbriae of female present, the former sometimes reduced to a band almost like apical bands of preceding terga. bb. Pygidial plate of female well defined, dull, with longitudinal median elevated zone (represented by pair of subparallel ridges or carinae in C. braunsiana, in which area between these ridges is depressed almost to level of rest of plate; similar ridges in C. aliciae close together so that elevated zone is narrow). cc. Pygidial plate of male absent. dd. Sternum VI of male strongly bilobed with added pair of lateroapical lobes so that margin is commonly four-lobed; lobes hairy, often with coarse specialized hairs. ee. Sternum VII of male variable. ff. Sternum

VIII of male with broad, subtruncate or rounded apical process which in situ often looks like a pygidial plate. gg. Gonostylus indistinguishably fused to gonocoxite, probably much shorter than to nearly as long as gonocoxite, not bifid, without inner process or projection bearing large hairs.

Comments. This genus, which is restricted to southern Africa, is closely related to Hesperapis. The species have the aspect of the middle-sized to small species of Hesperapis. Most of the characters listed are plesiomorphic but the elevated or at least defined median zone of the pygidial plate of the female is a synapomorphy (also found in the Sambini, where it must be of independent origin). Another probable synapomorphy, not always evident in preparations and not described above, is the presence of retrorse, apparently eversible, membranous, dorsal, preapical lobes on the penis valves. They are shown in Figure 177 for C. braunsiana; they exist in other species including C. aliciae although they were not visible in the specimen of that species illustrated in Figure 171.

The other characters that differentiate Capicola from Hesperapis are listed under the latter genus; some are synapomorphies for Hesperapis. Rozen and McGinley (1974) found synapomorphies separating larvae of Hesperapis from those of Capicola s. str. The groups would perhaps have been recognized at the subgeneric rather than generic level except for the enormous geographic distance separating Hesperapis in North America from Capicola in South Africa. Previous authors have sometimes united the genera (Cockerell and Ireland, 1933), some of the African species having been described as Hesperapis (Cockerell, 1934).

Subgenus Capicola s. str.

Capicola Friese, 1911, p. 672.

Type species: Capicola braunsiana Friese, 1911 (monobasic).

Rhinochaetula Friese, 1911, p. 185.

Type species: Capicola (Rhinochaetula) cinctiventris Friese, 1912, by designation of Cockerell, 1915, p. 343.

Diagnosis. Differs from Capicoloides by the lack of large, blunt, spine-like hairs in the tibial scopa and the broad, apically bilobed body of sternum VII of the male.

Description. a. Labial palpus surpassing apex of glossa. b. Outer surface of hind tibia of female without spine-like hairs interspersed among scopal hairs. c. Sternum VI of male broadly truncate, apical margin with four lobes bearing thickened setae, median lobes divergent. d. Sternum VII of male with body rather broad, apex bilobed. e. Gonostylus of male broad, rather long, blunt, outer surface with well defined area of coarse, dense setae.

Comments. Characters c, e, and perhaps d are synapomorphies that characterize the subgenus. The hind tibiae of certain males (C. rufiventris Friese) are greatly expanded apically, triangular, with the tibial spurs widely separated. The male of C. flavitarsis Friese has hind tibiae intermediate between the ordinary unmodified type and that of C. rufiventris.

The identity of C. cinctiventris is important because it is the type species of Rhinochaetula and because the name has been used for a species here placed in the subgenus Capicoloides. This name was proposed by Friese (1912) as a subgenus of Capicola for three species that supposedly differed from Capicola proper in having the middle tibial spur of the female minutely serrate ("ciliate") instead of having a few coarse teeth. Actually, only one of the three species, plumipes Friese, exhibits this character and it is tentatively placed in Promelitta. The type species of Rhinochaetula, then, regardless of what species it really is, has a tibial spur like that of most other Capicola. The type specimen of C. cinctiventris in Zoologisches Museum, Berlin, is labelled "Bushmanld./Jackals Water/Lightfoot." It agrees with an identically labelled specimen in the South African Museum, Cape Town, Friese (1912), however, gave the locality as "Ookiep," in "Kl. Namaland." I therefore suspected that the type was erroneous. However, Dr. E. Königsman of the Berlin museum was doubtful, indicating that Friese often made errors in citing localities. At my request Dr. Königsman compared the photograph that Friese published in his original description with the type specimen. The photograph was undoubtedly of that specimen, as shown by positions of wings, legs, etc. There is nothing in the original description of C. cinctiventris contrary to this interpretation. This information validates the type specimen and shows that Rhinochaetula is a synonym of Capicola s. str.

This subgenus includes the following species: braunsiana Friese, 1911 [= aurescens Cockerell, 1932; turneri (Cockerell, 1934)]; cinctiventris Friese, 1912; flavitaris Friese, 1912; nanula Cockerell, 1936; rufiventris Friese, 1912 (= femorata Friese, 1924; callura Cockerell, 1932; nivea Cockerell, 1932). The synonymies indicated above are not always based on type material and should be verified when the species are revised, although types of Friese's species and cotypes (= paratypes) of some of Cockerell's were studied.

Nests of C. braunsiana were described by Rozen (1974).

Various other forms that doubtless fall in this subgenus have been named, for example by Cockerell (1934).

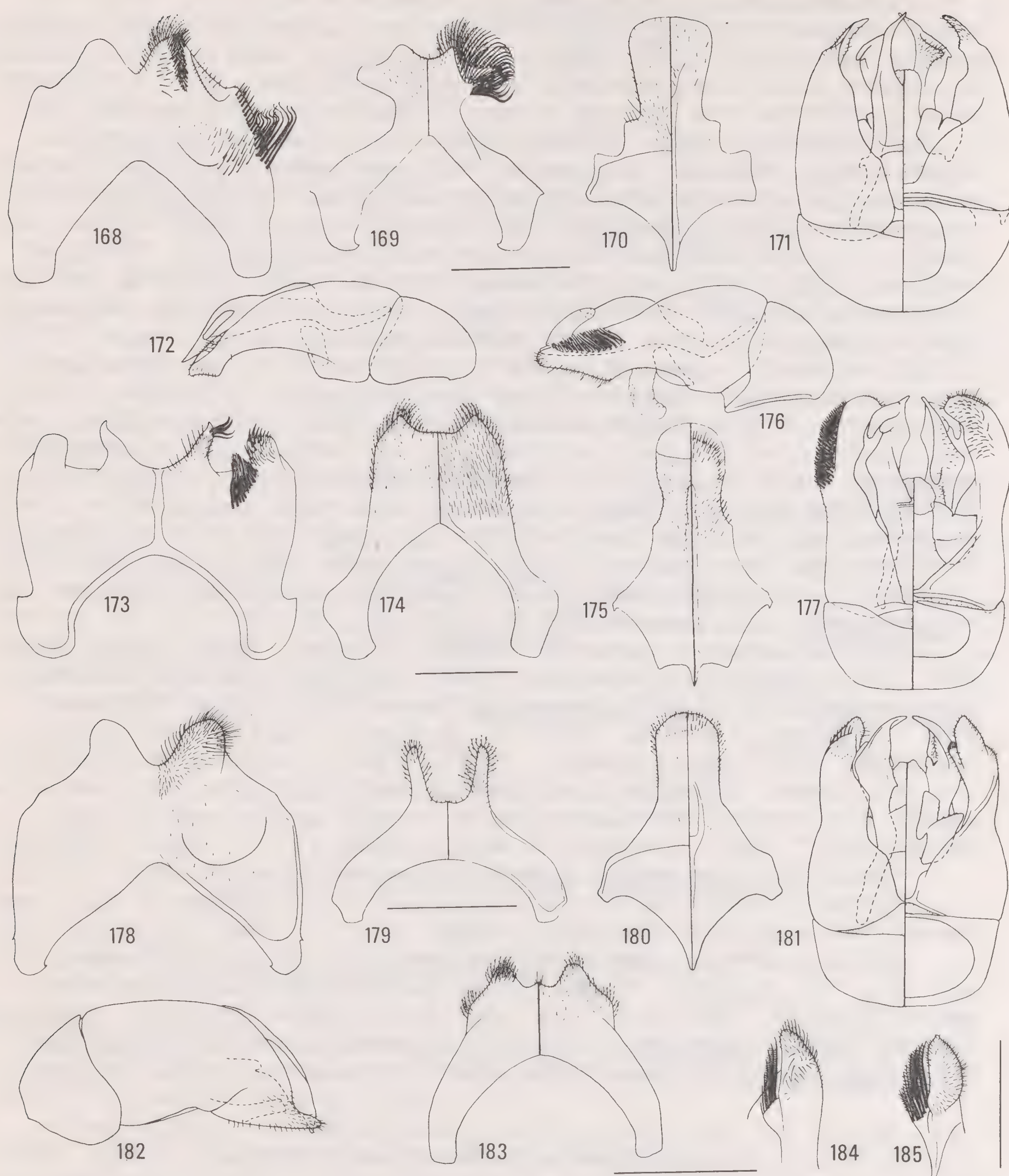
I have examined types of Rhinochaetula (?) armaticeps Friese, 1913, and R. (?) capensis Friese, 1913. Both are species of the colletid genus Scapter, and form the new combinations Scapter armaticeps (Friese) and S. capensis (Friese). The last mentioned is not the same as Polyglossa capensis Friese, 1909, which is presumably also a Scapter.

Capicoloides Michener new subgenus

Type species: Capicola aliciae Cockerell, 1932.

Diagnosis. Outer surface of hind tibia of female with large, blunt, spine-like hairs among scopal hairs; sternum VII of male with body reduced, apex with laterally directed lobes.

Description. a. Labial palpus attaining apex of glossa. b. Outer surface of hind tibia of female with large, rather short, blunt, dark tipped spine-like hairs interspersed among the long scopal hairs from basitibial plate to tibial apex. c. Sternum VI of male with apex bilobed, extending well beyond small lateral lobes (Fig. 168), median lobes not divergent. d. Sternum VII of male with body reduced, narrow



Figures 168-185. Capicola and Hesperapis, males. 168, Sternum VI, C. (Capicoloides) aliciae Cockerell (ventral). 169, 170, Sterna VII and VIII (dorsal and ventral) of same. 171, 172, Genitalia (dorsal, ventral, and lateral) of same. 173, Sternum VI, C. (Capicola) braunsiana Friese (ventral). 174, 175, Sterna VII and VIII (dorsal and ventral) of same. 176, 177, Genitalia (lateral, dorsal, and ventral) of same. 178, Sternum VI, H. (Panurgomia) pellucida Cockerell (ventral). 179, 180, Sterna VII and VIII (dorsal and ventral) of same. 181, 182,

basally, expanded to laterally projecting lobes apically (Fig. 169). e. Gonostylus slender, apparently rather short (base not defined), without area of coarse, dense setae.

Comments. This subgenus is especially distinctive because of the small seventh sternum of the male, which bears lateroapical lobes. For bees in general this is doubtless a plesiomorphy, for it is a widespread feature among the short-tongued families. However, if the cladograms (Figs. 1, 2) are correct, this character of Capicoloides may be a reversion, since Eremaphanta has sternum VII about as in Hesperapis and Capicola s. str. The gonostyli of Capicoloides lack the specialized areas of setae which seem to be apomorphous in Capicola proper, again suggesting a plesiomorphous condition for Capicoloides. The only obvious apomorphy for this subgenus is character b.

The only included species known to me is C. aliciae Cockerell. Specimens probably to be included in C. aliciae were identified by Cockerell as C. cinctiventris Friese. If this identification were correct, the name Rhinochaetula would be available for this subgenus. (See notes under the subgenus Capicola.)

Genus Hesperapis Cockerell (Figs. 178-190)

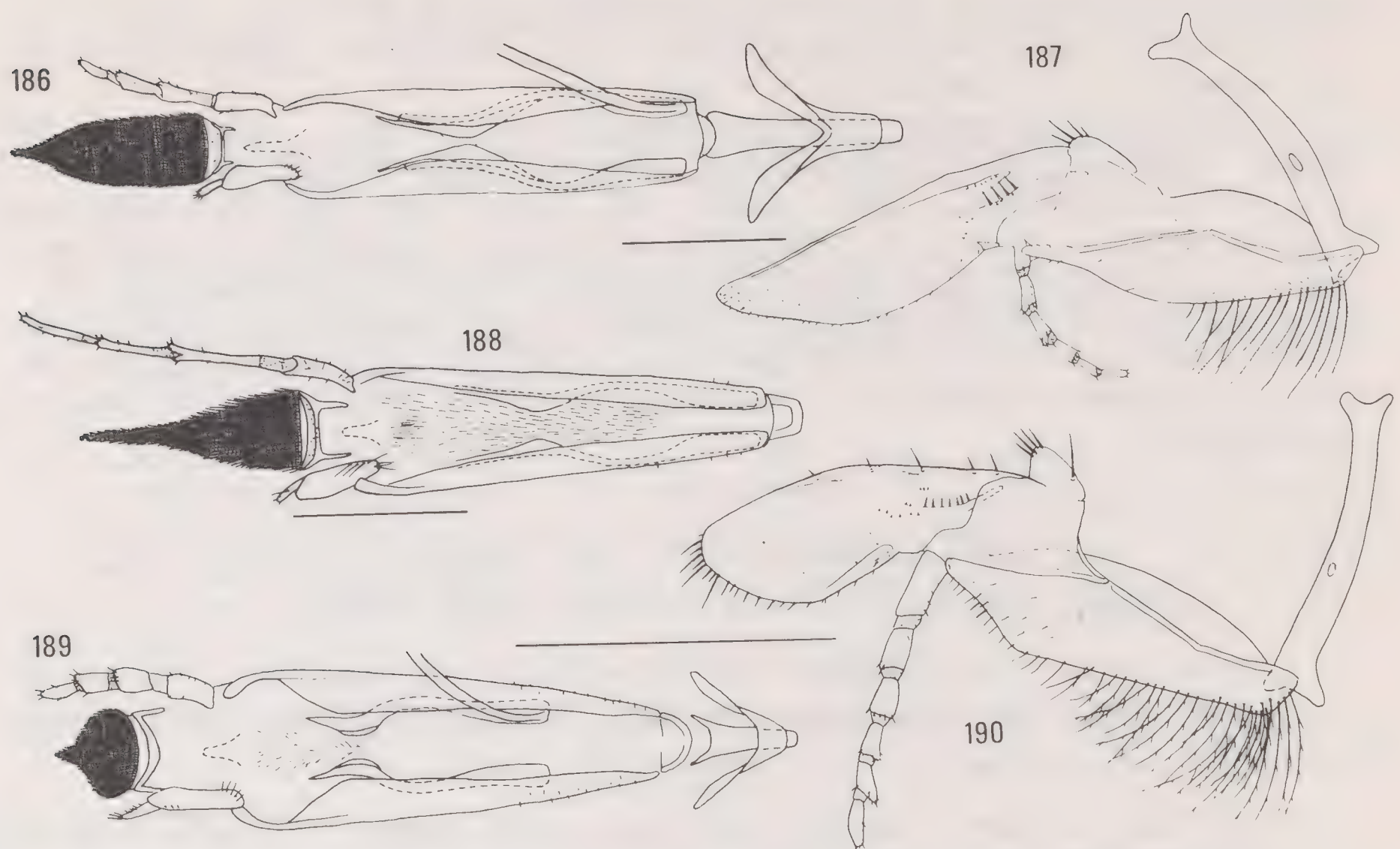
Diagnosis. Bees usually with a fasciate metasoma and form similar to that of Halictus, but metasoma of female much flattened and integument soft. The only close relative except Xeralictoides is Capicola, from which it differs by the lack of a longitudinal median raised or defined area on the pygidial plate of the female, and the presence of a process or lobe, usually with long hairs, on the inner side of the base of gonostylus (or perhaps apex of gonocoxite).

Description. a. Small to large (4-15 mm long), with form of a Halictus; yellow integumental markings absent, or in male of H. rufipes, lower half of clypeus yellow. b. Head broader than long to about as broad as long, vertex convex seen from front, sometimes straight, or in some with "long" head and elevated vertex, slightly concave. c. Labrum of male less than four times as wide as long, rarely little over twice as wide as long, two thirds smooth, often shining, convex, sometimes protuberant mediobasally, no sharp ridge separating basal smooth zone from distal punctate, hairy zone. d. Labrum of female usually about four times as wide as long, rarely little over twice as wide as long, basal convex zone smooth or dull, sometimes forming a rounded ridge separating it from apical hairy zone along margin, or sometimes (e.g., H. ilicifoliae) with sharp transverse ridge near base. e. Flagellar segments of male mostly longer than broad to broader than long, segment 2 distinctly broader than long, segment 1 sometimes broader than long even in some species with most segments elongate. f. Flagellar segments of female as described for Capicola. g. Maxillary blade usually about as illustrated for H. pellucida (Fig. 187), rarely very short and

Genitalia (dorsal, ventral, and lateral) of same. 183, Sternum VII, H. (Zacesta) rufipes (Ashmead) (ventral). 184, Ventral view of gonostylar region of same. 185, Ventral view of gonostylar region of H. (Carinapis) carinata Stevens. Scale lines = 0.5 mm; scale is the same for all figures of any one species.

rounded (*H. ilicifoliae*), sometimes pointed; galeal fringe insignificant to moderately developed. h. Galeal comb with four to nine spines; maxillary palpus not attaining to exceeding apex of galea. i. Prementum quite variable in length of ligular arms (Figs. 186, 188, 190). j. Glossa usually rather long and pointed, very short in *H. ilicifoliae* (Fig. 190). k. Paraglossa as described for *Capicola*. l. Labial palpus not attaining to exceeding apex of glossa, segments 2 and 3 subcylindrical, apices not produced laterally. m. Basal vein as described for *Capicola*. n. Stigma as described for *Capicola* or in largest species of subgenus *Carinapis* less than half as long as costal margin of marginal cell, vein r joining stigma at distal third, and margins of stigma basal to vein r parallel. o. Prestigma about one third to about one half as long as stigma. p. Apex of marginal cell as in *Capicola*. q. Jugal lobe of hind wing one fourth to three fourths as long as vannal lobe. r. Propodeal triangle large, smooth, sometimes striate or pitted at base, or densely punctate throughout; propodeum seen in profile with basal third or more distinctly more horizontal than posterior declivous surface except in some species of subgenus *Carinapis* in which only basal zone is slightly more horizontal, or entire propodeum declivous as in *Dasypoda*. s. Basitibial plate as in *Capicola* or occasionally only posterior margin defined. t. Scopa and other hind tibial hairs as in *Capicola* or in some species of subgenus *Carinapis*, scopal hairs with a few barbs and shorter plumose hairs absent; band of keirotichia as in *Capicola* or narrow, often only one third as wide as tibia, in subgenus *Carinapis*. u. Tibial spurs as described for *Capicola*, most subgenera having more or less fine adjacent teeth on middle spur of female but some *Carinapis* having coarse, well separated teeth. v, w. Mid and hind basitarsi of female broadest near bases, narrowed apically, giving rise to segment 2 near middle of narrow apex. x. Distitarsi as described for *Capicola*. y. Claws as in *Capicola* but cleft sometimes reaching nearly half way to base. z. Tergal bands as described for *Capicola*, tergum V often with a band like preceding terga. aa. Prepygidial and pygidial fimbriae present, the former often reduced to a band like those of preceding terga (see character z). bb. Pygidial plate of female well defined, without longitudinal median elevated or delimited area. cc. Pygidial plate of male absent except in some *Carinapis*. dd. Sternum VI of male rather flat, apically bilobed. ee. Sternum VII of male broad, short, flat, transverse, apically strongly bilobed. ff. Sternum VIII of male as described for *Capicola* but apex rarely exposed enough to resemble a pygidial plate. gg. Gonostylus indistinguishably fused to gonocoxite, probably nearly as long as gonocoxite, with an inner basal lobe or process (perhaps gonocoxal in origin) which, except in the subgenus *Panurgomia*, bears long, coarse, hairs which are barbed or plumose.

Comments. This North American genus contains species very similar to those of the African *Capicola*. Much of the above description describes ranges of variation different from those of *Capicola*, but not characters by which the two genera can be distinguished. The following characters, however, do differentiate these two genera: h (reduced galeal comb), r (larger propodeal triangle), bb, gg. Of these, h and gg appear to be synapomorphies for *Hesperapis* (plus *Xeralictoides*). There are also larval synapomorphies of *Hesperapis* (several subgenera) that separate it from *Capicola* s. str. (Rozen and McGinley, 1974). An additional character is the lack of the membranous, retrorse, subapical projections of the penis valves characteristic of *Capicola*. This



Figures 186-190. Mouthparts of *Hesperapis*. 186, 187, Anterior view of labium and inner view of maxilla of *H. (Panurgomia) pellucida* Cockerell. 188, Anterior view of labium of *H. (Zacesta) rufipes* (Ashmead). 189, 190, Anterior view of labium and inner view of maxilla of *H. (Amblyapis) ilicifoliae* (Cockerell). Scale lines = 0.5 mm.

character as well as *r* and *bb* are presumably plesiomorphies, being shared with various other genera of Dasypodinae.

The characteristic lobe (character *ss*) on the inner surface of the gonoforceps is hereafter referred to as a process of the gonostylus, although its morphological origin is not certain.

The nesting biology of several species has been described by Stage (1966).

The following material on the subgenera of *Hesperapis* is extracted from an unpublished thesis by Dr. G. I. Stage (1966) with his permission. The recognition of most of the subgenera is entirely his. Paragraphs that are nearly identical to his, or modified only by minor shortening, are followed by the notation "(Stage)." Paragraphs based upon Stage's material but largely reorganized are followed by the notation "[Stage]". His almost unmodified descriptions of all the new subgenera, are therefore described and named by him, as is the genus *Xeralictoides*. Aside from shortening, species lists (names extracted from his work, but not quoted), and comments designed to make his style more compatible with the rest of this paper, the only significant taxonomic differences between his work and what follows are (1) recognition of *Zacesta* as a subgenus different from *Hesperapis* s. str., and (2) recognition of *Xeralictoides* as a genus different from *Hesperapis*. Both of these changes are made at the request of Dr. Stage. I have modified Stage's key to subgenera in accordance with this request, but it uses

the same characters in essentially the same way as his key.

In each subgeneric description, the diagnostic combination of characters is indicated by underlines.

Relationships among the Subgenera of Hesperapis. While the following comments do not agree with those of Stage (1966), partly because mine are less detailed, they would not have been possible without Stage's study. Table 3 lists the subgeneric variables (as well as generic characters for Xeralictoides) for which plesiomorphic vs. apomorphic alternatives are recognizable on the basis of distribution of the characters in other Melittidae. Figure 191 shows the distribution of the apomorphies among the subgenera; it is modified from Stage's cladogram.

TABLE 3. LIST OF APOMORPHIES FOR XERALICTOIDES AND HESPERAPIS (MODIFIED FROM STAGE, 1966).

1. Males larger than females. [A rare feature of bees, not found in other melittids, although evident in Anthidium (Megachilidae), etc.]
2. Vestiture primarily short, appressed, and dense. [In most bees the pubescence is more erect, more sparse, and commonly longer, also commonly less densely plumose.]
3. Oral vestiture of female composed of simple, long, apically wavy hairs. [In most melittids it is composed of shorter, sparser, plumose hairs.]
4. Oral vestiture of female composed of long, dense hair. [See character 3.]
5. Head as long as broad or nearly so. [Head markedly broader than long in most melittids.]
6. Vertex concave medially seen from front. [The vertex is flat, or in most Dasypodini/ convex, in most bees. In others where it is concave, the concavity is broad, while in Xeralictoides it is a rather small median concavity.]
7. Clypeus flat. [The clypeus is convex in most melittids.]
8. Prementum and labial palpi long (Fig. 188). [These structures are of ordinary length in most melittids.]
9. Mesoscutum narrow, so that intertegular distance is less than its length. [The mesoscutum is distinctly shorter than the intertegular distance in most melittids. This is character 66 of Table 1.]
10. Propodeal triangle dull, contiguously punctured, in contrast to adjacent areas. [In other melittids, the triangle is either similarly sculptured to adjacent parts of the propodeum, or is more shiny than adjacent areas.]

11. Front tibia with several apical and subapical setae of outer surface greatly thickened, spine-like. [Such modification unknown in other bees. This is character 43 of Table 1.]
12. Hind femur with subapical pit on posterior surface. [This feature is not known in other bees. This is character 7 of Table 1.]
13. Basitarsal scopa parted, i.e., hairs diverging along posterior (= upper) margin of basitarsus, so that this margin is bare. [In other melittids the hairs do not diverge in this way and some of them arise from the margin.]
14. Tergum V of female with apical hair band similar to those of preceding segments. [In most melittids the prepygidial fimbria is distinct from the bands of the preceding terga.]
15. Pygidial plate of female with area of plumose hairs medially. [In other melittids such a hairy area is absent.]
16. Sternum VI of male with apical lobes apically fringed, otherwise glabrous. [In other Hesperapis the lobes have erect subapical brushes.]
17. Sternum VII of male with apical lobes long and slender, about four times as long as greatest breadth. [In other Hesperapis and related bees these lobes are relatively short and broad.]
18. Gonostylus with inner lobe bearing two brushes. [In other Hesperapis the inner lobe bears one brush or is hairless.]
19. Gonostylus with inner lobe cylindrical, glabrous. [In other Hesperapis the inner lobe has one or two brushes of hair.]
20. Penis valve biramous and strongly angled basolaterally. [In other Dasypodini the penis valves do not show these features.]

Amblyapis lacks all of the apomorphies listed in Table 3. It could therefore be a paraphyletic group from which Xeralictoides and other groups of Hesperapis arose. Zacesta has its own apomorphies, not all shared with any other group of Hesperapis. All the remaining taxa are united by character 14, i.e., the prepygidial fimbria of the female is reduced to an apical band like that of preceding terga. Although some Capicola show the same attribute, and in Eremaphanta it is carried to an extreme, there is no evidence that it arose more than once in the Hesperapis-Xeralictoides group. If it did arise independently, of course other taxa would arise from the lowest furcation of the cladogram, which would become a quinquefurcation. Placement of the remaining taxa is indicated in Figure 191, which suggests that Carinapis is a paraphyletic group from which Hesperapis s. str. and Panurgomia arose.

It should be noted that, although far apart in the cladogram (Fig. 191), Hesperapis s. str. and Zacesta are quite similar, so that Stage (1966) united them under the former name. Two of the three apomorphies

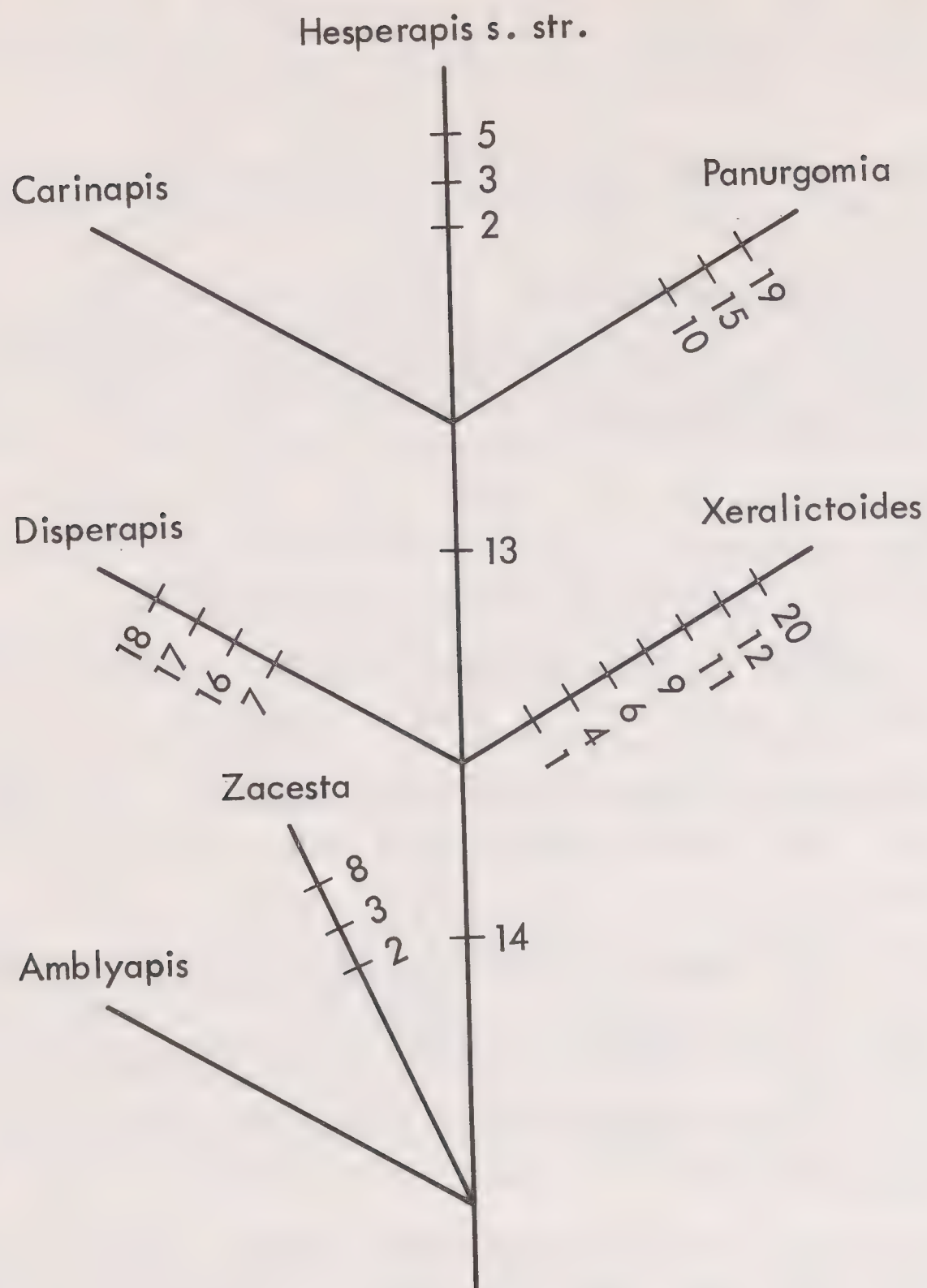


Figure 191. Cladogram for the subgenera of Hesperapis and the genus Xeralictoides. The numbers represent apomorphies listed in Table 3. The data are from Stage (1966).

for each subgenus shown in the figure are the same. If characters 13 and 14 could be shown to arise independently in different taxa, then Zacesta-Hesperapis could be viewed as a single taxon near the root of the cladogram. Independent development of character 14 is not improbable; it clearly arose independently in the closely related genus Capicola. Character 13, however, appears to be a unique development; it is not known in any other bees.

Key to the Subgenera of Hesperapis
(modified from G. I. Stage, 1966)

1. Propodeal triangle contiguously punctured throughout and dull, in contrast to sparsely punctured and shining posterior and lateral propodeal surfaces; pygidial plate of female more or less flat with

- mesal area bearing patch of appressed, plumose hairs.
-----Panurgomia
- Propodeal triangle smooth and shiny, at most anteriorly rugose or irregularly punctured, or if dull and closely punctured, then posterior and lateral propodeal surfaces are similar; pygidial plate of female often strongly convex with elevated basal triangle, always without mesal hair patch.
-----2
2. Females
-----3
- Males
-----7
3. Hairs along upper (i.e., posterior) margin of hind basitarsus parted, margin being narrowly hairless and exposed.
-----4
- Hairs along upper (i.e., posterior) margin of hind basitarsus not parted, arising on as well as on both sides of the margin.
-----5
4. Pygidial plate with elevated, triangular basal area margined by carinae which meet posteromedially (except in H. oliviae which lacks these carinae); body length 7-15 mm.
-----Carinapis
- Pygidial plate flat with shallow longitudinal sulcus near apex, without elevated area; body length 6-7 mm.
-----Hesperapis s. str.
5. Head length only slightly less than width (9:10), so that head seems elongate; labial palpus with segment 2 much longer than 1.
-----Zacesta
- Head length much less than width; labial palpus with segment 2 little if any longer than 1.
-----6
6. Flagellar segment 1 at least 1.6 times length of 2.
-----Disparapis
- Flagellar segment 1 equal to or shorter than 2.
-----Amblyapis
7. Labial palpus with segment 2 much longer than 1; head about as long as broad.
-----Zacesta
- Labial palpus with segment 2 little if any longer than 1; head distinctly broader than long (except in some Hesperapis s. str.).

-----Amblyapis, Carinapis, Disparapis and Hesperapis s. str.

Good subgeneric characters are difficult to find among many males. The following key to males that run to the second alternative of couplet 7 in the above key utilizes species-group characters, so that most subgenera come out in two or more places.

Key to the Subgenera of Certain Male Hesperapis
(modified from Stage, 1966)

1. Body length greater than 6 mm or metasomal terga without white apical hair bands.
-----2
- Body length 6 mm or less and metasomal terga with distinct, white, apical hair bands.
-----Hesperapis s. str.
2. Pygidial plate absent, metasomal tergum VII covered with pubescence.
-----3
- Bare, subtriangular pygidial plate present, usually elevated and defined by carinae at least apically.
-----Carinapis
3. Posterior lobe of pronotum normal, not produced into spine; galea either pale, reticulate, heavily punctured or with surface hair or apical fringe.
-----4
- Posterior lobe of pronotum produced into stout, weakly recurved spine; galea dark, very sparsely punctured, otherwise glabrous.
-----Carinapis
4. Metasomal sternum VI with apical lobes acute, dull, and bearing inner, subapical brush of suberect hair; metasomal terga with apical pale hair bands occasionally very weakly developed or absent.
-----5
- Metasomal sternum VI with apical lobes rounded, shiny and relatively free of hair except for apically directed marginal fringe, metasomal terga always with distinct pale apical hair bands.
-----Disparapis
5. Metasomal terga with uniform sized, well spaced punctures, shiny in appearance.
-----6
- Metasomal terga with irregular sized, contiguous punctures, dull in appearance.

- Amblyapis
6. Small species, less than 7.5 mm in length.
-----7
- Large species, more than 7.5 mm in length.
-----Carinapis
7. Apical lobes of metasomal sternum VI with subapical margins nearly straight and inner margin of each lobe bearing elongate, submarginal brush of suberect hair.
-----Carinapis
- Apical lobes of metasomal sternum VI with apices produced laterally and inner margin of each lobe bearing subovate, submarginal brush of hairs in a whorl.
-----Amblyapis

Subgenus Amblyapis Cockerell

Halictoides (Amblyapis) Cockerell, 1910, p. 362.

Type species: Halictoides (Amblyapis) ilicifoliae Cockerell, 1910 (monobasic and original designation).

Diagnosis. See characters underlined below.

Description. Small bees, slightly over 4 to 9 mm in length. Head: Integument black or very dark brown with appendages often lighter. Vestiture variable, generally suberect, sparse and long in females, that of male longer and more dense, often obscuring integument, particularly on face around antennal bases and clypeus laterally; oral vestiture normal, not modified as in female of Hesperapis. s. str. Head broad with length from slightly less than 0.75 to slightly more than 0.85 width; inner orbits of eyes nearly parallel to weakly convergent below in female and weakly to strongly convergent below in male; vertex seen from in front medially flat or weakly convex in female, more strongly convex in male; clypeus weakly protuberant and weakly convex; first three flagellar segments variable but 1 or 2 never longer than 3; mandible of female generally narrowly rounded apically with well developed inner subapical tooth, that of male similar but with subapical tooth area weakly produced into blade. Mesosoma: Integument usually black, sometimes dark reddish-brown on appendages. Vestiture generally longest on mesepisternum and lateral faces of propodeum, shorter and sparser on mesoscutum and very short and sparse or lacking on metepisternum. Posterior lobe of pronotum not produced into recurved spine; propodeal enclosure similar to adjacent areas, smooth or at most anteriorly sculptured, but otherwise shiny and not punctured as in Panurgomia (except in H. arida where it is so punctured but adjacent parts of propodeal integument are also heavily punctured and dull); jugal lobe between two thirds and three fourths length of vannal lobe; mesotibial outer vestiture primarily uniformly plumose but often with thick, spinose hairs intermixed apically; mesotibial spur translucent white, spiculate over entire length, margins finely serrate; metatibial spurs similar to mesotibial spurs; tibial scopa usually with plumose decumbant hairs

among long scopal hairs in some areas; basitarsal scopa not parted along posterior (= dorsal) margin of basitarsus. Metasoma: Integument dark reddish-brown to black, usually the latter, terga I-IV of females bearing pale apical hair bands; tergum V with coarse pubescence (prepygidial fimbria) appearing distinctly different from preceding terga; terga of male with hair bands either absent or very poorly developed and inconspicuous (except for H. leucura and H. arida where hair bands are well developed). Pygidial plate (female only) variable but not like that of Disparapis, Panurgomia or Carinapis; sternum VI of male with apical lobes acute, laterally directed and bearing brush or erect hair in a whorl on inner subapical margin; sternum VII of male with apical margin medially acutely produced or not between the two major lobes which are well developed and narrowly rounded apically; male genitalia with gonostylus bearing inner lobe with well developed marginal fringe composed usually of both simple and plumose long hairs. (Stage)

Comments. This subgenus contains six species, one of which has not been published. The named species are H. (Amblyapis) ilicifoliae (Cockerell, 1910), parva Michener, 1937; larreae Cockerell, 1907; leucura Cockerell, 1924; arida Michener, 1936. The range of the subgenus is in deserts from west Texas to Baja California, California, and Nevada and in chaparral regions of southern and central California. At least some of the species are oligolectic, but on unrelated plants so that there is no particular host group for the subgenus. [Stage]

Subgenus *Hesperapis* Cockerell s. str.

Hesperapis Cockerell, 1898, p. 147.

Type species: Hesperapis elegantula Cockerell, 1898 (monobasic).

Diagnosis. See characters underlined below.

Description. Small species, usually less than 6 or 7 mm long. Head: Integument black except for apical margin of clypeus and appendages which may be reddish. Vestiture variable but mostly short, dense, almost entirely plumose and often nearly obscuring integument of face and vertex; vestiture on inner basal parts of mandibles, on stipes laterally, on prementum ventrally, and on genae and occiput adjacent to proboscoidal fossa composed of long, simple, apically wavy hairs in female; short, plumose in male. Head nearly round seen from in front with length at least nine-tenths width (except in some males where head is usually slightly shorter); inner orbits of eyes slightly converging below in female, weakly converging in male; vertex convex; clypeus strongly convex and protuberant apically; flagellar segments 1 and 2 equal in female, 3 only slightly longer; in male 2 slightly longer than 1 and 3 markedly so; middle flagellar segments of male much longer than broad. Mandible with small preapical tooth, not broadened into blade. Mesosoma: Integument usually shiny, black except legs which may be reddish. Vestiture primarily composed of densely plumose hair and generally short and dense on mesoscutum, longer and less dense but appressed on pleural areas and longer, more dense and appressed on propodeum. Posterior lobe of pronotum normal, not produced into recurved spine; propodeal enclosure sculptured or smooth but always shiny and never punctured as in Panurgomia; jugal lobe between two-thirds and three-fourths length of vannal lobe; mesotibial outer

vestiture dense, primarily uniformly plumose but females with thick, spinose hairs sparsely intermixed apically; mesotibial spur primarily translucent silvery-white, spiculate except at apex, margins very finely serrate; metatibial spurs similar to mesotibial spurs; tibial scopa with short, plumose decumbant hairs among long simple hairs in some areas; basitarsal scopa parted, i.e., with distinct narrow longitudinal division exposing posterior (= dorsal) edge of basitarsus. Metasoma: Integument largely reddish in female, black or very dark brown, nearly black in males. Terga bearing apical hair bands, that of tergum V of female like that on preceding terga. Pygidial plate (female only) without basal pubescence as in Panurgomia or basal triangle as in Carinapis; sternum VI of male with apical lobes large, laterally directed and apically bearing erect hairs forming dense brush; sternum VII of male with apical margin produced into two broadly rounded lobes with simple emargination between them; male genitalia with gonostylus bearing inner lobe with well developed marginal fringe composed of both simple and plumose long hairs. (Stage)

Comments. Of the three species in this subgenus as here restricted, only one, Hesperapis elegantula Cockerell, has been published. The subgenus occurs in deserts from western Texas to Idaho, Nevada, and California. For pollen collecting the subgenus may be restricted to the boraginaceous genus Coldenia. [Stage]

Subgenus Zacesta Ashmead

Zacesta Ashmead, 1899, p. 73.

Type species: Zacesta rufipes Ashmead, 1899 (monobasic).

Diagnosis. See characters underlined below.

Description. Small species, usually less than 6 or 7 mm long. Integument black except that H. rufipes has apical part of clypeus reddish in female and yellow in male, legs reddish in male of H. rufipes. Vestiture mostly short, dense, plumose, nearly obscuring integument of face and vertex, especially in male; vestiture of oral region not specialized as in females of Hesperapis s. str. Head nearly round seen from front; inner orbits scarcely converging below in female, more strongly so in male; vertex seen from front flat or feebly concave medially in female, feebly convex in male; clypeus strongly convex and protuberant apically; first three flagellar segments not much different in lengths; middle flagellar segments of male much broader than long. Mandible of male with inner tooth broadened into a blade. Mesosoma: Integument shiny, black except for legs which may be brown. Vestiture primarily densely plumose, mostly short and dense on mesoscutum, longer and less dense on pleural areas, longer, more dense and appressed on propodeum. Posterior lobe of pronotum normal, not produced into spine; propodeal enclosure smooth, shiny; jugal lobe .70 to nearly .75 times length of vannal lobe; mesotibial outer vestiture dense, mostly uniformly plumose but females with thick, spinose hairs sparsely intermixed apically; mesotibial spur translucent silvery white, with very finely serrate margins, lacking coarse serrations; metatibial spurs similar; tibial scopa with short, plumose decumbant hairs among long simple hairs; basitarsal scopa not parted along posterior (= dorsal) edge of basitarsus. Metasoma: Integument largely red in most females and some

males. Terga bearing apical hair bands, that of tergum V of female coarser, slightly darker, and forming broader band (= prepygidial fimbria) than on preceding terga. Pygidial plate (female only) without basal pubescence or triangle. Sternum VI of male as described for Hesperapis s. str.; sternum VII of male with apical margin produced to two rounded lobes, emargination between them produced to small median angle; genitalia as described for Hesperapis s. str.

Comments. Stage (1966) included two species in this group, which he included in the subgenus Hesperapis s. str. Of these only one, H. rufipes (Ashmead), has been named. Both species are known only from the arid parts of central and southern California. For pollen collecting the subgenus appears to be restricted to a few genera of Polemoniaceae, especially Eriastrum (= Hugelia). [Stage]

Disparapis Stage new subgenus

Type species: Hesperapis arenicola Crawford, 1917.

Diagnosis. See characters underlined below. The extremely long, narrow, apical lobes of sternum VII and the peculiar structure of the inner lobe of the gonostylus with its two hair brushes are unique sub-generic characteristics of the males.

Description. Small to moderately large, 8-14 mm long. Head: Integument usually black but may be dark reddish-brown; appendages may also be dark reddish-brown. Vestiture mostly erect, sparse and long in females, that of males longer and more dense, often obscuring integument of face and particularly of clypeus; oral vestiture normal, not modified as in female of subgenus Hesperapis. Head broad, length 0.75 to 0.85 width; inner orbits of eyes weakly convergent below in female, strongly convergent below in male; vertex seen from in front medially flat or weakly convex in female, strongly convex in male; clypeus of female weakly protuberant apically and primarily flat, becoming convex only laterally; clypeus of male similar but more convex; flagellar segment 1 in female at least 1.7 times length of 2 and always much longer than 3, in male 1 subequal to or shorter than 2 (except in H. arenicola) and 2 shorter than 3; mandible of female narrowly rounded apically with well developed acute subapical tooth, of male broadly rounded apically with subapical inner tooth area weakly developed into blade (except both sexes of H. arenicola in which mandibles are apically acute and lack subapical tooth). Mesosoma: Integument usually black, appendages sometimes dark reddish-brown. Vestiture relatively long, suberect and sparse on mesoscutum, scutellum, metanotum, mesepisternum and posterior and lateral faces of propodeum and nearly lacking on metepisternum. Posterior lobe of pronotum not produced into spine; propodeal enclosure smooth or at most sculptured anteriorly, shiny, never punctured as in Panurgomia; jugal lobe about two-thirds length of vannal lobe; mesotibial outer pubescence plumose, without or with only several inconspicuous, thick, spinose hairs intermixed; mesotibial spur of females amber colored, spiculate or not, with single inner row of coarse serrations composed of well developed distinct teeth, of male translucent white, spiculate, finely serrate; metatibial spurs of both sexes similar to mesotibial spurs of male; tibial scopa with plumose hairs among long scopal hairs in some areas; basitibial scopa not parted along posterior

(= dorsal) margin of basitarsis. Metasoma: Integument shiny, dark reddish-brown to black, usually the latter. Terga bearing apical pale hair bands, that of tergum V of female similar to those on preceding terga, Pygidial plate (female only) uniform, weakly convex basally, weakly concave apically, with abruptly reflexed edges, surface finely papillose, sometimes with faint rugae sparsely superimposed; pygidial plate lacking elevated basal triangle as in Carinapis and basal pubescence as in Panurgomia; sternum VI of male with apical lobes broadly rounded (laterally subacute in H. arenicola), smooth and shiny, without dense suberect brush of hair but apically fringed; sternum VII of male with apical margin acutely produced medially and with two apical lobes extremely long, narrow, apically somewhat thickened and rounded; male gonostylus bearing lobe with two distinct brushes, one dorsally directed, one posteriorly directed. (Stage)

Comments. This subgenus contains three species only one of which, H. (Disparapis) arenicola Crawford, 1917, has been published. The subgenus occurs in deserts from west Texas and Zacatecas to Baja California, California, and Utah. The species are probably restricted to the Compositae for pollen collecting. [Stage]

Subgenus Panurgomia Viereck

Panurgomia Viereck, 1909, p. 48.

Type species: Panurgomia fuchsi Viereck, 1909 (monobasic).

Diagnosis. See characters underlined below. The structure of the inner process on the gonostylus of the male is unique to this subgenus.

Description. Medium sized bees, 7-15 mm long. Head: Integument black except for occasional reddish-brown clypeus and gena posteriorly; mouthparts primarily reddish-brown, thick parts often very dark. Vestiture generally suberect, sparse and long in females, that of males longer and more dense, often nearly obscuring integument, particularly around antennal bases and on clypeus; oral vestiture not modified as in female of Hesperapis s. str. Head shape variable, even in different populations of a single species, length varying from about 0.75 to 1.01 times width; inner orbits of eyes nearly parallel to weakly convergent below in female, weakly to strongly convergent below in male; vertex seen from front weakly convex medially; clypeus weakly convex, variously protuberant apically; flagellar segment 1 at least 1.5 times length of 2, usually longer, and usually distinctly longer than 3 in female, often subequal to or shorter than 3 in male; mandible of female subacute apically with well developed inner subapical tooth; mandible of male apically rounded with subapical tooth weakly broadened into blade. Mesosoma: Integument usually black; pleural areas, propodeum and appendages may be reddish-brown. Vestiture short and sparse on mesoscutum, relatively long, suberect and sparse on mesepisternum and lateral surface of propodeum, gradually becoming shorter towards posterior face of propodeum; metepisternum nearly bare with only short and sparse plumose hair. Posterior lobe of pronotum not produced into spine; propodeal enclosure coarsely, uniformly, contiguously punctured, duller than sparsely punctured, shiny, adjacent propodeal integument; jugal lobe of hind wing one-fourth to three-fourths length of vannal lobe; mesotibial outer vestiture primarily uniformly plumose in male, female similar but with

thick, spinose hairs sparsely intermixed apically; mesotibial spur finely spiculate over almost entire length, finely serrate; metatibial spurs similar to mesotibial spurs; scopa with short plumose hairs reduced or lacking; scopa of basitarsus parted, i.e., with narrow longitudinal division exposing posterior (= dorsal) edge of basitarsus.

Metasoma: Integument red, reddish-brown or black, usually the latter. Terga bearing pale apical hair bands, that of tergum V in female similar to but often more sparse than those of preceding terga. Pygidial plate (female only) more or less flat, basomedially bearing appressed patch of plumose hair; sternum VI of male with apical lobes broadly rounded, bearing brushes of suberect plumose hair along apical margins; sternum VII of male with apical margin weakly, acutely produced medially and with pair of well developed, subacute or narrowly rounded lobes; male genitalia with gonoforceps bearing a short, brushless, subcylindrical process in place of inner lobe. (Stage)

Comments. Panurgomia, as recognized here, is a small, distinct subgenus whose species are similar. Species included by Stage (1966) are Hesperapis regularis (Cresson, 1878); fuchsi (Viereck, 1909); semirudis Cockerell, 1910; nitidula Cockerell, 1916; pellucida Cockerell, 1925, and wilmattae Cockerell, 1933. The subgenus ranges from Arizona, Sonora, and Baja California to northern Nevada and California, in both deserts and mesic foothill areas. Pollen collecting is from different families of plants--Onagraceae, Papaveraceae, and perhaps Compositae. [Stage]

Carinapis Stage new subgenus

Type species: Hesperapis carinata Stevens, 1919.

Diagnosis. See characters underlined below. The structure of the pygidial plate in the female is a unique character for this subgenus. Though not universal in Carinapis, the spineform posterior lobe of the pronotum and the well developed male pygidial plate are diagnostic characters when present since neither occurs in other subgenera.

Description. Medium to moderately large bees, 7 to 16 mm long with most species near larger end of range. Head: Integument usually black, rarely dark reddish-brown; appendages black or more often reddish-brown with antenna sometimes orange below. Pubescence generally sparse and long in female, that of male longer and more dense, often obscuring integument, particularly around antennal bases and clypeus; oral vestiture not modified as in female of Hesperapis s. str. Head broad, length varying from 0.75 to 0.86 width in female and from 0.72 to 0.81 width in male; inner orbits of eyes nearly parallel to weakly convergent below in female, weakly to strongly convergent below in male; vertex seen from front medially flat or weakly convex in females, usually much more convex in males; clypeus weakly protuberant, usually weakly convex, sometimes nearly flat or even concave; first three flagellar segments variable in male, in female segment 1 longer than 3, 3 longer than 2 (except in H. fulvipes female where 2 and 3 are subequal, each shorter than 1, and in H. macrocephala female where 1 and 3 are subequal, each longer than 2); mandible of female generally narrowly rounded or subacute apically with well developed inner subapical tooth, that of male apically similar to that of female but with inner subapical edge

weakly produced into blade. Mesosoma: Integument usually black, sometimes dark reddish-brown or even yellowish-brown on appendages. Vestiture generally long and dense (except on H. oliviae), longest on mesepisternum and lateral face of propodeum, shorter and sparser on mesoscutum and very short and sparse or lacking on metepisternum. Posterior lobe of pronotum either normal or greatly produced into recurved spine; propodeal enclosure smooth or at most sculptured anteriorly, otherwise shiny, not punctured as in Panurgomia (except H. macrocephala where it is similarly punctured but adjacent parts of propodeum are also heavily punctured and dull); jugal lobe between one-half and two-thirds length of vannal lobe; mesotibial outer pubescence primarily uniformly plumose, without thick, spinose hairs intermixed; mesotibial spur variable, those of female from spiculate and very finely serrate to smooth and coarsely serrate like those of most Capicola, those of male usually spiculate and very finely serrate along inner edge; metatibial spurs similar to mesotibial spur of male; scopa usually with short plumose hairs among long hairs; scopa of basitarsus parted, i.e., with distinct, narrow longitudinal division exposing posterior (= dorsal) edge of basitarsus. Metasoma: Integument black, dark reddish-brown or yellowish, usually the former. Terga bearing pale, apical hair bands, that of tergum V in female similar in color, size and composition to those of preceding terga. Pygidial plate of female with raised, sub-triangular area, laterally margined by carinae, in basal middle (except H. oliviae where raised basal area lacks carinate margins); tergum VII of male either normal or with bare, raised, at least apically carinate, triangular, pygidial plate; sternum VI of male with apical lobes acute, laterally directed and bearing linear brush of erect hairs on inner subapical margin; sternum VII of male with median apical margin weakly or strongly produced, with well developed pair of narrowly rounded to subacute apical lobes; male genitalia with gonostylus bearing inner lobe with well developed brush or fringe composed of both basally thick, long plumose hairs and shorter, often simple hairs. (Stage)

Comments. Carinapis contains more species and has a greater total distribution than any other subgenus. Included are fifteen species, six previously described, whose combined distributions cover much of North America from Oregon, North Dakota and Illinois south to Baja California, Morelos, and northern Florida. Described species are Hesperapis carinata Stevens, 1919; fulvipes Crawford, 1917; macrocephala Cockerell, 1924; oliviae (Cockerell, 1897); rhodocerata (Cockerell, 1897); and rodecki Cockerell, 1934. Most species collect pollen from Compositae, but some from Malvaceae and perhaps other families. [Stage]

Xeralictoides Stage new genus

Type species: Hesperapis laticeps Crawford, 1917.

Diagnosis. Distinguished from Hesperapis by the narrow mesoscutum, spinose front tibia, and subapical pit on the posterior surface of hind femur. Agrees with description of Hesperapis except for the strongly concave to flat median part of the vertex seen from front, and can be recognized especially by the characters indicated by underlining below, in the description which was prepared by Stage (1966) for comparison with subgenera of Hesperapis (see Comments under Hesperapis for attribu-

tion of Stage's material).

Description. Medium sized bees, 7-10 mm long, with males generally as large as or larger than most females in any given population. Head: Integument black except for clypeus which may be dark reddish-brown and appendages which may be reddish or yellowish. Vestiture generally long, suberect and sparse on posterior vertex and gena, shorter but more dense and subappressed on face around antennal bases and lateral to clypeus where integument is nearly obscured; clypeus nearly bare in female, sparsely covered with short appressed hair in male; female with vestiture of inner basal area of mandible, stipes laterally and ventrally and areas adjacent to probosidial fossa unusually dense, with hairs long and minutely-barbed; corresponding vestiture in males short, normal. Head shape relatively uniform with length usually slightly more than 0.90 width in females and between 0.85 and 0.90 width in males; inner orbits of eyes nearly parallel or slightly converging below; vertex seen from in front strongly concave to flat medially, usually the former; clypeus moderately convex and protuberant apically; flagellar segments 1 to 3 usually subequal though segment 2 may be slightly shorter; mandible of female broadly rounded apically with subapical tooth weakly developed; mandible of male not toothed, entire distal half of inner margin expanded into a broad blade. Mesosoma: Integument black or dark reddish-brown. Vestiture short and sparse on mesoscutum, relatively long, suberect and sparse on mesepisternum, short, appressed, fairly dense and conspicuous on metepisternum and long, dense and subappressed, obscuring integument, on posterior and lateral faces of propodeum. Posterior lobe of pronotum normal, not produced into spine; minimum intertegular distance less than length of mesoscutum; propodeal enclosure smooth, finely reticulate or anteriorly striate but always shiny and never punctured as in *Panurgomia*; jugal lobe of hind wing between seven-tenths and three-fourths length of vannal lobe; front tibia with outer apical portion spinose; mesotibial outer vestiture plumose, with thick, darker spinose hairs sparsely intermixed at least apically; mesotibial spur finely spiculate over basal three-fourths, inner margin with a few coarse, well separated teeth in female, rather finely serrate in male; hind femur with shallow, subapical pit on posterior surface; metatibial spurs rather robust, curved, margins finely serrate; scopa with short plumose hairs in addition to long scopal hairs; basitarsal scopa not parted along posterior (= dorsal) margin of basitarus. Metasoma: Integument reddish to black. Terga bearing pale, apical hair bands, that of tergum V in female similar in color, size and composition to those on preceding terga. (In some specimens more and coarser hairs, suggesting a prepygidial fimbria, occur middorsally on tergum V.) Pygidial plate (female only) without basal pubescence as in *Panurgomia* or elevated basal triangle as in *Carinapis*, apical half commonly with longitudinal median gentle ridge or convexity; sternum VI of male with apical lobes acute, laterally directed and bearing brush of erect hair on inner apical margins; sternum VII of male with apical margin produced medially and with two well developed subacute apical lobes; male genitalia with gonostylus bearing inner lobe covered with thick brush composed of long recurved plumose hairs; penis valve strongly laterally angulate near base and bearing a basal inner ramus (Stage)

To complete the characterization of *Xeralictoides* in terms of descriptions of other dasypodine genera, I list the following characters not included in Stage's description. Except for characters h and r,

these limit the variability expressed in the description of Hesperapis rather than indicating differences from that description. (Galeal combs have not been examined for all species of Hesperapis; some may have large combs like those of Xeralictoides.) c, d. Labrum about three times as broad as long, convex, smooth and shining except for narrow, hairy apical zone. e. Flagellar segments of male mostly longer than broad. f. Flagellar segments of female mostly broader than long. g. Maxillary blade about as illustrated for Hesperapis pellucida but with strong marginal fringe. h. Galeal comb well developed, with about 12 spines; maxillary palpus exceeding apex of galea. i. Ligular arms long, extending nearly to base of prementum. l. Labial palpus not quite attaining apex of glossa. m. Basal vein a little over 1.5 times as long as first abscissa of Rs, curved throughout, distal to cu-v. n. Stigma as described for Capicola. o. Prestigma less than half as long as stigma. r. Propodeum seen in profile with subhorizontal basal zone nearly as long as posterior declivous zone.

Comments. Xeralictoides contains two species, only one of which, Hesperapis laticeps Crawford, has been named. These species from the deserts of California and Nevada, are associated with two loasaceous plants, Eucnide and Mentzelia. Further study of host preference and floral behavior should be particularly interesting since the oral vestiture of the female is modified apparently to aid in pollen collection and perhaps even transportation. This vestiture, composed of unusually long, dense, minutely barbed hairs, frequently is packed heavily with pollen. [Stage]

As shown in Figure 191, Xeralictoides is a derivative of Hesperapis; its recognition makes the latter a paraphyletic genus. I believe that it is reasonable and desirable to recognize paraphyletic taxa when phenetic considerations justify such action. In this case, I consider the recognition of Xeralictoides at the generic level on phenetic grounds debatable. It is clearly the most distinctive of the groups derived from a proto-Hesperapis ancestor, as shown by the seven apomorphies on its stem in Figure 191, as well as by characters h and r above whose directionality is not known. For me these are reasonable indications of generic distinctness. A decisive factor, however, was recognition of Xeralictoides at the generic level by its describer, Dr. G. I. Stage (personal communication), whose knowledge with this group greatly exceeds my own. Phenetically (i.e., in terms of number of characters) Xeralictoides is more different from Hesperapis than is Capicola, but cladistically Xeralictoides obviously falls with Hesperapis, since it shares with Hesperapis the synapomorphies that distinguish that genus from Capicola.

Etymology. Named with reference to the halictid genus Xeralictus which visits the same flowers and is superficially similar in appearance.

APPENDIX I. THE SPECIES OF MEGANOMINAE

This subfamily, under the generic name Meganomia, was reviewed by Stage (1971). Keys and descriptions of the genera are in the body of the present paper. Most of the structural differences among the forms are incorporated in those descriptions. The taxonomic descriptions below are therefore largely limited to characters of sculpture and coloration.

Genus Ceratonomia

This genus, so far as known, contains only the species described below.

Ceratonomia rozenorum Michener new species
(Figs. 7, 10, 14-18, 47, 48, 57, 58, 198)

Meganomia sp. B, Rozen, 1977, p. 2.

Diagnosis. Last antennal segment of male black, flattened, discoid; scutum and scutellum of both sexes finely punctate, nearly as closely so as is possible; basitibial plate of female clearly defined.

Description. Size and structure as indicated in generic description. Male: Coloration. Black, the following parts yellow: labrum; mandible except red-brown apex; clypeus; paraocular area, extending up along eye margin to truncated summit half way from antennal base to ocelli; supraclypeal area extending up to area above antennal bases and continued as line to small yellow area below median ocellus; band along posterior orbit, narrowed and separated from eye above, broadened and joining yellow hypostomal area below; most of stipes; scape except dorsal black streak on distal half; pedicel and flagellar segment 1 except dusky areas on dorsal surfaces; posterior margin of pronotum, both laterally and dorsally, including much of pronotal lobe; anterior half of tegula except testaceous translucent margin; axillary sclerites; posterior margin of scutellum, yellow extending forward sublaterally to varying extent; axilla; metanotum except laterally; venter of thorax, extending up to middle of side on anterior surface of mesepisternum; small spots at lower and upper ends of metepisternum; legs except for black arolia, distal parts of claws, extreme bases of coxae, broad band along upper inner surface of hind femur, and band along inner surface of hind tibia; two large and almost contiguous spots on anterior surface of metasomal tergum I, bands across terga I-VI, gradually narrowed medially and broadened laterally, each approximately median on its tergum, being immediately anterior to broad, depressed, marginal zone; bands of terga I-III sometimes with small sublateral emargination or enclosed black spot on posterior edge sublaterally; tergum VII (reddish posteriorly); metasomal sterna (posterior ones reddish). Flagellar segments 2-10 and base of 11 reddish yellow. Posterior half of tegula translucent testaceous. Wings slightly dusky, especially apically; veins and stigma dark brown except for yellow to yellowish-brown costa of forewing.

Pubescence. White, rather long and dense in vicinity of antennae and ocelli, on genal and hypostomal areas; stipes; and thorax (dorsum of last with intermixed very short hairs--see subgeneric description). Metasomal terga I-V with rather long, well separated hairs arising just basal to depressed marginal zones, which are hairless. Punctuation. Lower two thirds of face with punctures of various sizes intermixed, separated by less than a puncture width of shining ground except for nearly impunctate longitudinal median clypeal line. Upper part of face and especially vertex with small punctures widely separated by minutely roughened, dull ground. Scutum and scutellum dull, finely and closely punctate, with scattered larger punctures from which long hairs arise. Sides of thorax with rather close irregular punctures separated by very little, but shining, ground. Propodeal triangle dull, granular. Terga (except for broad, depressed, minutely roughened posterior marginal zones) rather finely punctate, with intermixed larger punctures from which longer hairs arise, punctures progressively coarser on more posterior terga; ground between punctures dull on first few terga, becoming more shiny posteriorly. Sterna more finely punctate than terga, ground between punctures minutely roughened but shining. Female:

Coloration. Black, the following parts yellow: basal two thirds of mandible; clypeus except light brown apical margin; paraocular area as in male but part above antennae more broadly yellow; supraclypeal area (yellow area not reaching antennae); band along posterior orbit, but slightly separated from orbit, especially above; small spot behind and mesal from summit of eye; under side of scape; posterior margin of pronotum (as in male or sometimes with little yellow below pronotal lobe); tegula, axillary sclerites, scutellum, axilla, metanotum and metepisternum as in male; posterior margin of propodeal triangle except medially; apices of femora, on fore and mid legs extending nearly to bases on under sides; tibiae, except brown hind basitibial plate covered with short black hair; tarsi, becoming reddish distally (claws and arolia colored as in male); anterior surface of metasomal tergum I; bands like those of male on terga I-V, but bands not or little narrowed medially, sublateral posterior emarginations not isolated as spots; anterior metasomal sterna reddish yellow or partly yellow, grading to black on V and VI. Labrum light brown. Pedicel and flagellar segments light brown beneath, dusky above, the darker coloration more extensive on basal halves of most segments. Wing coloration as in male.

Pubescence. Mostly white, areas of long hairs on head less conspicuous than in male, that of vertex and dorsum of thorax ochraceous, of under sides of tarsi reddish yellow, of basitibial plate black; prepygidial fimbria and hairs on either side of pygidial plate dense, black.

Punctuation. As described for male but area anterolateral to posterior ocellus with few punctures on minutely roughened ground; tergal punctuation coarser and deeper, contrasting even more with posterior marginal zones; sternal punctures coarser but less dense than tergal.

Type material. Holotype male, South West Africa (= Namibia): 17-19 km east Usakos, March 18, 1976 (J. G. and B. L. Rozen). Allotype female, same data but taken March 26. Nine male and eight female paratypes, same data as holotype but two of each sex taken March 29 and two females on March 22. Rozen (1977) reports that these bees were collecting pollen on Indigofera. Two male and nine female paratypes, 13 km west of Karibib, March 14, 16, 24, and 26, 1979 (J. G. and B. L. Rozen), on flowers of Petallidium except two females on Indigofera. The type

material is in the American Museum of Natural History except for two pairs of paratypes each in the Snow Entomological Museum, University of Kansas, and the British Museum (Natural History).

Etymology. This species is named for the collectors, Dr. and Mrs. J. G. Rozen, in recognition of their interesting work on Meganomia, its allies, and many other bees.

Genus *Uromonia*

So far as known this genus contains only the species described below.

Uromonia stagei Michener new species (Figs. 8, 11, 19-24, 53, 57, 58, 197)

Diagnosis. The smallest known meganomiine (10-12 mm long); antenna simple; propodeum of female nearly all yellow; blade of galea fringed with long hairs.

Description. Size and structure as indicated in generic description. Male: Coloration. Head and thorax black, metasoma black to red-brown (holotype with first and base of last tergum red-brown, others nearly black), legs often brown, the following parts yellow (often pale yellow, especially on metasoma and tarsi, sometimes elsewhere): labrum; mandible except reddish-black apical two fifths; clypeus; paraocular area extending up along eye margin to truncated summit half way between antennal bases and ocelli; supraclypeal area extending upward between and above antennal bases; small spot (often asymmetrical or absent) anterolateral to lateral ocellus; scape except for dorsal black streak on distal half; under side of pedicel and flagellar segment 1; stripe along under side of flagellar segments 6-11; posterior margin of pronotum, both laterally and dorsally, broken middorsally and variably at side, including most of pronotal lobe; anterolateral area on mesoscutum; streak along notaulus on anterior part of mesoscutum; pair of small spots (or in some paratypes a broken line) across posterior margin of mesoscutum (or this area all black); spot on tegula; outer half of median axillary sclerite; posterior third (or in some, half) of scutellum; posterior half (or in some, two thirds) of metanotum; sternum between middle and hind coxae (in some extending forward to front coxae); large areas on ventral surfaces of coxae, trochanters, and femora; tibiae except dark brown areas on posterior surfaces, largest on hind tibia where there is more brown than yellow; basitarsi; small segments of front tarsus, large areas on small segments of middle tarsus, and small areas on these segments (especially segments 2 and 5) of hind tarsus; narrow bands just anterior to depressed marginal zones of terga I to VI, these bands narrowed at lateral extremities, then continued anteroventrally on ventrolateral parts of terga; most of dorsal surface of tergum VII; sterna I to IV and part of V (remaining exposed sterna red

Figures 192-198. Outer views of hind legs of males of Meganomiinae. Shaded areas brown or black, clear areas yellow. 192,



Agemmonia tsavoensis (Strand). 193, Meganomia binghami (Cockerell). 194, M. gigas n. sp. 195, M. rossi n. sp. 196, M. andersoni (Meade-Waldo). 197, Uromonia stagei n. sp. 198, Ceratonomia rozenorum n. sp. Scale lines = 0.5 mm.

brown). Flagellum dark brown, lighter beneath, except for yellow areas. Tegula and axillary sclerites light brown except for yellow areas. Wings slightly dusky, a dark streak beyond apex of marginal cell; veins and stigma brownish black, black basally, costa mostly brown. Pubescence. Dull white, fuscous on vertex, and with black or fuscous hairs intermixed on scutum and more densely on scutellum; metasomal terga with hairs that mostly look pale in some lights but fuscous in others, depressed marginal zones hairy. Punctuation. Lower half of clypeus with moderately coarse punctures of variable sizes; rest of clypeus with small punctures, widely but variably separated by shining but finely roughened ground; longitudinal median ridge impunctate. Supraclypeal area more densely punctate than adjacent areas. Rest of face with small punctures widely separated by shining but finely roughened ground. Vertex dull, largely without distinct punctures, but with numerous small punctures in ocellar triangle. Genal area with punctures separated by about a puncture width. Dorsum of thorax dull, minutely granular, hair bases distinct but not in conspicuous punctures. Sides of thorax with small, shallow punctures separated by shining but minutely roughened ground. Metasomal terga dull, granular, with widely separated small punctures, larger and more conspicuous on areas just anterior to depressed marginal bands; seventh tergum with coarser punctures, particularly in area of pygidial plate. Sterna with large, impunctate although finely roughened areas; punctuation more prominent on posterior sterna. Female: Coloration. Head and thorax black and legs brownish to black, the following parts pale yellow: basal third of mandible; lateral third and longitudinal median stripe on clypeus, these areas united along apical clypeal margin; lower paraocular area, not reaching subantennal suture, truncate at level of antennal base, but extending well above that level as slender pointed projection along inner orbit; irregular area on supraclypeal area, extending upward between antennae to level well above antennal bases; under side of scape; posterior margin of pronotum (less yellow than in male); streak along notaulus on anterior part of mesoscutum; transverse band across posterior margin of mesoscutum; spot on tegula; outer half of median axillary sclerite; posterior three fifths of scutellum; most of axilla; metanotum; metepisternum; propodeum except for propodeal pit; apices of front and middle femora (extending well toward base on upper surface of mid femur); anterior and much of under surfaces of front and middle tibiae; and most of outer surfaces of front and middle basitarsi. Metasomal terga I-IV yellowish brown with apical depressed zones dark brown; pale yellow bands as in male but somewhat broader, terga II-IV with basal yellow bands also, joined to other yellow bands laterally, and separated from them only by irregular yellowish brown bands; tergum V yellow with brownish black apical margin; tergum VI brownish yellow, pygidial plate dark brown; terga III and IV with brownish black blotches at extreme sides, not visible from above. Sterna I-III yellow, II and III with blackish median blotches; sterna IV and V red brown; sternum VI brown. Labrum and extreme anterior margin of clypeus reddish brown. Flagellum dark brown above, light brown beneath. Tegula transparent testaceous except for yellowish spot. Axillary sclerites light brown except for yellow area. Tarsi reddish brown except for yellow areas. Wings as in male. Pubescence. Of head and thorax as described for male except that on under surface of mesothorax and metathorax and associated coxae and trochanters, it is stiff and brassy. Metasoma with hairs of

first tergum nearly all white, of second partly so; remaining terga with hairs fuscous or blackish, depressed marginal zones II to IV with blackish hairs. Prepygidial fimbria and hairs beside pygidial plate blackish. Pubescence of legs white, yellowish on undersides of tarsi, patch of black hairs on outer side of middle tibia apically and on base of hind tibia, including basitibial plate. Punctuation. That of head and thorax similar to that of male; punctures of head coarser than in male and those of clypeus nowhere widely separated. Metasomal terga with ground somewhat shining, more so on posterior terga, but depressed marginal zones dull; punctures minute on marginal zones, larger elsewhere, finer and more widely separated than in male except on terga V and VI and sides of IV where they are coarser. Sterna II and III largely shining, minutely roughened, with only widely separated minute punctures, but posterior margins of each finely and densely punctate; other sterne nearly wholly finely and densely punctate.

Type material. Holotype male, allotype female, and one female and 14 male paratypes, Kenya: 13 miles (21 km) south of Malindi, 26 May 1967 (C. D. Michener). The locality is approximately at sea level and within 2 km of the coast. The holotype and allotype are in the Snow Entomological Museum, University of Kansas; paratypes are in the American Museum of Natural History, and the British Museum (Natural History).

Etymology. This species is named after Dr. G. I. Stage in recognition of his work on melittid bees.

Genus Agemmonia

This genus contains two named forms, as indicated below. The male of A. tsavoensis is here described for the first time.

Agemmonia tsavoensis (Strand)
(Figs. 9, 12, 25-30, 54, 57, 58, 192)

Nomia tsavoensis Strand, 1920, p. 93.

Meganomia tsavoensis: Cockerell, 1931a, p. 201; Stage, 1971, p. 312.

Description. Size and structure as indicated in generic description. Male: Coloration. Black, the following parts pale yellow or yellowish white: clypeus except narrow black apical margin; lower paracocular area, narrowed abruptly at level of antennal bases, and continued along eye margin well above that level; lower part of supraclypeal area (colored area over twice as broad as long); small V-shaped mark or pair of converging marks in front of ocelli; area on genal area, upper end of which diverges from posterior orbit; pair of transverse marks on posterior pronotal margin dorsally (one specimen only); spot on tegula; outer part of median axillary sclerite; sometimes weak streak along anterior part of notaulus; spot on axilla; pair of ventroapical streaks on hind femur; spot on base of each tibia, often continued as stripes that run length of outer sides of tibiae or such stripes indicated by isolated area on each tibia, such white areas beyond basal spots sometimes absent on front and middle tibiae; narrow bands across

metasomal terga just anterior to depressed marginal zones, band of tergum I broken medially and sometimes divided into four small spots, bands of terga II-V with broad sublateral emarginations on anterior margins, that of II sometimes broken medially, band of tergum VI broken into three spots. Labrum, median third of mandible, under side of distal half of flagellum, distitarsi, and axillary sclerites (except yellow area) brown. Arolia and apices of claws black. Tegula except for yellow spot translucent testaceous, blackish anteriorly. Wings yellowish brown, more dusky apically; veins brown, stigma infuscated. Pubescence. Rather short, that of head and thorax strongly plumose, rather long on under side of head including mandibles, and on stipes and front coxae; pubescence of legs and metasoma extremely short. Color mostly whitish, slightly ochraceous on vertex, mesoscutum, and scutellum, strongly ochraceous on venter of thorax and coxae. Punctuation. Lower half of face with punctures of various sizes intermixed, separated by somewhat shining, minutely roughened ground; longitudinal clypeal ridge impunctate. Rest of head and thorax with minute punctures widely separated by dull ground, punctures somewhat coarser and ground more shining on genal area and lower three fourths of mesepisternum. Metasomal terga almost without recognizable punctures except for VI and VII, surface dull, more shining on VI and VII. Sterna a little more conspicuously punctate than terga. Female: Coloration. Black, legs and metasomal venter red brown, the following parts pale yellow: small spot on base of mandible (nearly absent in one specimen); clypeus except black apical margin; paraocular area as in male but with narrow point along eye margin up to level of ocelli; supraclypeal and frontal marks as in male; genal mark as in male but larger; spot on pronotal lobe and pair of transverse marks on posterior margin of pronotum dorsally; spot on tegula; outer part of medial axillary sclerite; lateral stripe on scutum; stripe along notaulus, attenuated posteriorly but joining side of triangular spot, of which there is a pair on posterior scutal margin; transverse streak on each side of posterior half of scutellum (one specimen); axilla; transverse band on anterior half or two thirds of metanotum; lateral area of metanotum; broad arcuate band across base of propodeal triangle; basal spots on front and middle tibiae; narrow bands across metasomal terga anterior to depressed marginal zones, those on terga III-V more or less midway between these zones and graduli, band of tergum I broadly broken, of tergum II rather narrowly broken, of terga III-V very narrowly broken or continuous. Labrum and under side of scape brown. Under sides of flagellar segments 4-10 red brown. Tegula blackish anteriorly, brown posteriorly (except for yellow spot). Small tarsal segments reddish brown, claws and arolia colored as in male. Wings as in male. Pubescence. As in male but not long and dense on undersides of head and front coxa, and not unusually short on legs and metasoma; hairs of legs and metasomal scopae ochraceous; hairs of terga ochraceous, fuscous to black on terga V and VI. Punctuation. As described for female, but lower part of face with fewer coarse punctures.

Type material. The type, from the Tsavo River, Kenya, taken in May, a female, is in the Musee Royal de l'Afrique Centrale, Tervuren. I have not studied it. It was redescribed by Cockerell (1931a). It has slightly less extensive yellow markings (e.g., more broadly broken metasomal bands) than the material on which the above description was based.

Distribution. Known only from Kenya, but probably occurs in arid lowland parts of adjacent countries. The specimens on which the above description is based were from the Mombasa-Nairobi highway 80 km northwest of Mombasa, 31 May 1967 (C. D. Michener).

Agemmonia tavetensis (Cockerell)

Meganomia tavetensis Cockerell, 1934, p. 444; Stage, 1971, p. 311.

Description. Size and structure as indicated in the generic description. Female: Agrees with description of *A. tsavensis* except as follows: Yellow of paraocular area with slender upper orbital point reduced, not reaching level of ocelli; yellow stripes along notauli not reaching spots on posterior scutal margin; outer surfaces of front and middle tibiae largely yellow; and yellow tergal bands broad, only the first narrowly broken, the others continuous and occupying most of the space between the gradulus and the anterior margin of the apical depressed zone on each tergum.

Type material. The holotype, from the Lumi River, Taveta, Kenya, taken in December, is in the British Museum (Natural History). The paratype, on which the above comments are based, is in the National Museum of Natural History, Washington; it is from the type locality.

Comments. This is probably a color form (i.e., synonym) of *A. tsavoensis*. The female (male is unknown) seems morphologically identical to that species. The supposed difference (lack of the median clypeal ridge in *A. tsavoensis*) mentioned by Cockerell (1934) and Stage (1971) does not exist and is the result of an error. Strand (1920) mentioned such a ridge, but Cockerell (1931a), when he redescribed the type, failed to note it. When he described *A. tavetensis*, Cockerell (1934) evidently read his own earlier description but not Strand's, and therefore incorrectly concluded that the ridge was absent in *A. tsavoensis*. As pointed out by Stage (1971), the only known locality for *M. tavetensis* is in the same general area from which *A. tsavoensis* is known.

Genus *Meganomia*

This genus contains four distinct species separable by the keys below. Certain unusual features of some of the species are mentioned in the generic description and even in the subfamilial description, but to save space are not repeated in specific descriptions.

Key to females

1. Mesoscutum black or with yellow only near anterior margin, narrow stripes occasionally following notauli up to five sixths of length of scutum; yellow of clypeus continuous from side to side.
-----2
- Mesoscutum with yellow along lateral margins and yellow stripes along notauli extending nearly to posterior margin of mesoscutum;

yellow of clypeus divided by median black zone.

-----3

2. Clypeus and scutellum entirely yellow or clypeus with small black areas along upper margins; yellow band of first tergum continuous; forewing length over 13 mm.

-----gigas

- Clypeus with pair of basomedian black areas extending more than half way down clypeus; scutellum with at least anterior margin and commonly anterior half or more black; yellow band of first tergum broken medially; forewing length less than 12 mm.

-----binghami

3. Last antennal segment scarcely longer than broad; mesepisternum and metepisternum without yellow areas.

-----rossi

- Last antennal segment conspicuously longer than broad (as in binghami and gigas); mesepisternum and metepisternum with yellow areas.

-----andersoni

Key to Males

1. Flagellum not crenulate beneath, segments 8 to base of 11 of almost uniform width but apical part of 11 strongly narrowed and forming a hook; fore coxa produced posteriorly far behind base of trochanter; fore basitarsus with relatively short yellowish hairs; fifth tergum with two apical, black combs, one on either side of midline.

-----2

- Flagellum crenulate beneath, segments 8 to 11 progressively narrowed and commonly forming a hook; fore coxa not produced posteriorly behind base of trochanter; fore basitarsus with black brush of long hairs on under side; fifth tergum with a single median apical black comb.

-----3

2. Fore wing length 13 mm or more; yellow band of first tergum continuous; prominence on anterior margin of inner surface of posterior tibia nearly two thirds of distance from base to apex of tibia.

-----gigas

- Fore wing length under 12 mm; yellow band of first tergum usually broken; prominence on anterior margin of inner surface of posterior tibia little more than half way from base to apex of tibia.

-----binghami

3. Hind tibia with strong emargination in anterior margin; last antennal segment dark in contrast to three preceding segments.

- rossi
- Hind tibia without emargination in anterior margin; last antennal segment largely yellowish like three preceding segments.
- andersoni

Meganomia binghami (Cockerell)
(Figs. 31-36, 58, 193)

Nomia (*Meganomia*) *binghami* Cockerell, 1909, p. 402; Cockerell, 1910, p. 221; Hedicke, 1931, p. 35.

Nomia flavofasciata Friese, 1909, p. 170; Friese, 1930, p. 14.

Meganomia binghami: Cockerell, 1931a, p. 201; Cockerell, 1933a, p. 376; Cockerell, 1936, p. 27; Stage, 1971, p. 310.

Diagnosis. This species, like *M. gigas*, has only one slender apical antennal segment in the male. It differs from that species in the somewhat less extensive yellow maculations, those of the posterior part of the thorax and metasoma being bright yellow rather than pale as in *gigas*. The hind coxa of the male is thickened apically so that its under surface is well below that of trochanter, and in side view the coxa appears to have an apical ventral tooth.

Description. Male: Length 16-18 mm; forewing length 9.5-11.2 mm. Structure (characters listed are only those that vary within the genus). 1. Produced median lobe (truncation) of clypeal apex over one third as wide as clypeus, apex straight (truncate). 2. Frontal carina below antennal bases convex as seen in profile. 3. Apex of mandible with two teeth (apices of rutellum and pollex) of about equal length. 4. Labrum over 2.5 times as wide as long, flat, apex somewhat emarginate medially. 5. Flagellum not crenulate beneath, segment 1 nearly three times as long as broad, segment 2 longer than broad, subsequent segments progressively shorter so that 5 is about as broad as long and 11 is markedly broader than long; segment 12 equally broad at base but thereafter abruptly narrowed to form flat, strongly curved hook, longer than any flagellar segment except 1. 6. Front coxa projecting as a flat process, broadly rounded at apex, extending well behind base of trochanter. 7. Middle coxa with large, shining process projecting ventrad in front of base of trochanter. 8. Hind coxa in profile with broad apical tooth, its apex well below level of base of trochanter. 9. Hind femur less than twice as long as broad in side view. 10. Hind tibia viewed from inner side with prominence on anterior margin scarcely beyond middle. 11. Apex of hind tibia with anterior half (outer view) straight, slanting to rounded but acute anterior apical angle. 12. Front basitarsus with rather long hairs (one third as long as basitarsus) on posterior margin, other basitarsal hairs much shorter. 13. Hind basitarsus with strong outer ridge at base, which is then abruptly reduced (almost at a right angle) and forms an arcuately excavated under surface of median part of basitarsus. 14. Basal vein of forewing basal to cu-v and over five times as long as first abscissa of Rs. 15. Metasomal sternum IV without pair of strong tubercles on disc; sternum V with two apical black combs, one on each side of midline; base of ster-

num with two well defined, invaginated, membranous areas. 16. Apical lobes of sternum VI rounded, much broader than long. 17. Apex of gonocoxite with diagonal row of bristles on under surface from inner apical angle toward subapical outer margin. 18. Penis valves broadly fused basally. 19. Volsella as usual in the genus, with finger-like process projecting distally beneath basal part of penis. Coloration: Black, the following parts yellow: mandible except reddish-black apex; labrum; clypeus; supraclypeal area except lateral margin, yellow extending up as narrow line between antennae and sometimes half way to median ocellus; lateral face mark occupying entire lower paraocular area and above truncated half way between antennal base and lateral ocellus, sometimes extending beyond that level as narrow point along eye margin; small spot lateral to median ocellus; under sides of scape, pedicel, and flagellar segment 1; narrow line along lower half of posterior orbit; sometimes yellow area on upper half of genal area away from eye margin; large area on stipes; posterior margin of pronotum (broken mid-dorsally, broadened on posterior lobe which may be largely yellow, and extending down on lateral margin toward front coxa); area along anterior fifth of notaulus; commonly disjunct area lateral to notaulus near front of scutum; anterior half of tegula; axilla or large area on it; line along posterior margin of scutellum or posterior half of scutellum; transverse band occupying most of dorsal median part of metanotum; venter of thorax between coxae; under surfaces of coxae (including ventral process of mid coxa); trochanters to apices of tarsi of front and middle legs except brownish-black distal halves of claws, large black area on posterior side of front femur, basal black streak on dorsal side of front femur, small black spot on under side of front tibia, and black area on under and posterior side of middle tibia; hind trochanter, femur, tibia, and basitarsus yellow with irregular black areas on upper side of trochanter and femur extending onto front and rear surfaces of latter, blackish areas around femoro-tibial joint, black distal three fifths of inner surface of tibia extending onto upper and lower surfaces of tibia and as premedian band nearly across outer surface of tibia, and black posterior surface of basitarsus; transverse bright yellow bands in front of depressed posterior margins on metasomal terga I to VI, band on tergum I usually broken medially (sometimes broadly), on terga II to IV or V narrowed medially, that on II sometimes narrowly broken, on terga I to IV, V, or VI with shallow sublateral emargination on posterior margin, on VI with median notch in anterior margin; broad pale yellow bands, often broken medially, on sterna II to IV, with oval black spot on each side of each sternum, on IV spot sometimes represented by emargination in anterior margin of yellow band; posterior margin of sternum I sometimes narrowly yellow. Flagellar segments 1-10 blackish dorsally, 2-11 otherwise yellowish brown. Posterior half of tegula translucent red brown. Wings slightly brownish, membrane beyond veins dusky, veins and stigma dark brown to black. Pubescence. Moderately abundant, white, ochreous (fading to white) on vertex, dorsum of thorax, and metasomal dorsum, coppery on under sides of tibiae and tarsi. Punctuation. Punctures of whole body mostly separated by less than or only slightly more than a puncture width of slightly roughened ground, between ocelli small and dense, lateral to ocelli small and sparse, on scutellum distinctly sparser than on scutum and more widely separated with shiny ground between them; tergal margins broadly depressed, smooth, shining, with only scattered minute punctures and scattered hairs; sterna with punc-

tures small and inconspicuous. Female: Length 15-17 mm. Forewing length 11.5 mm. Structure. Labrum about 2.5 times as broad as long, apex medially emarginate. Inner orbits approximately parallel so that clypeal width is about equal to upper interorbital distance. Front coxal process narrowly rounded at apex, about half as long as trochanter. Wing venation as in male. Coloration. Black, the following parts yellow: basal half of mandible; clypeus except pair of black areas descending more than half way across clypeus from upper margin, sometimes surrounding and isolating yellow area between them; lower median part of supraclypeal area; lateral face mark as in male but truncation at upper end sloping upward away from eye; small spot lateral to median ocellus; under side of scape; band along upper half of genal area, away from eye margin; sometimes area on stipes; pronotal margin as in male or broken or absent below lobe which is usually largely yellow; short streak along anterior end of notaulus (in Beitbridge female over one-third length of scutum) and sometimes a dot (or large area in Beitbridge and Louis Trichardt specimens) lateral to anterior end of this streak; anterior half of tegula and streak along inner margin to posterior end of tegula; axilla or area on it; line along posterior margin of scutellum (broken medially) or usually posterior half of scutellum, or in Beitbridge specimen whole scutellum except anterior margin; band on metanotum as in male; band across and sometimes occupying whole dorsum of propodeal triangle, this band sometimes broken medially; sometimes pair of irregular spots on posterior surface of propodeum; dorsal apices of front and middle femora; basal third to half of front tibia except on under side, this yellow area continued as stripe that often fuses with distal patch on anterior surface; basal third of middle tibia except on under side; distal patch on anterior surface of middle tibia; bands on metasomal terga I to V in front of depressed marginal zones, that on I sometimes narrowly broken medially, on II and III somewhat narrowed medially, on I to IV with shallow sublateral emargination on posterior margin, on V broader than on other terga and with median notch on anterior margin often hidden by tergum IV. Labrum and tarsi brown. Flagellum black to brown above, yellow brown beneath. Tegula and wings as in male. Metasomal sterna and rarely also terga (between yellow bands) brown or dark brown. Pubescence. As in male but hairs of undersides of coxae and trochanters, and of thoracic sternum variably brassy; distal patches of coppery hairs on outer sides of fore and middle tibiae; hairs of truncate apex of hind femur fulvous, of basitibial plate red, grading to fuscous apically; prepygidial and pygidial fimbriae and hairs of sterna, especially apically, fulvous. Punctuation. As described for male but metasomal sterna more conspicuously punctate; depressed marginal zones of terga hairless or nearly so except laterally; tergum V without such a zone, apex densely hairy.

Type material. The type, a female, of *M. binghami* from Damarland, Namibia (South West Africa), is in the British Museum (Natural History). The type of *M. flavofasciata* from Grootfontein, Namibia, was a female but the specimen so labelled in the Zoologisches Museum, Berlin, is a male from Otjiverongo, presumably collected in 1920 and described by Friese in 1930. Obviously it is erroneously labelled as type. The true type is perhaps lost, but Friese's description clearly shows that it was a specimen of *M. binghami*, not *M. gigas* (e.g., length 15 mm; posterior half of scutellum yellow).

Distribution. Arid parts of southern Africa north of the Tropic of Capricorn. South Africa: 40 km north of Louis Trichardt, Transvaal, 610 m altitude, March 24, 1967 (C. D. Michener); 33 km north of Vanzylsrus, Cape Province, March 3, 1980 (V. B. Whitehead). Zimbabwe (Rhodesia): Beitbridge, April 12, 1932 (L. Ogilvie, A. Mackie). Namibia (South West Africa): 73-76 km south of Outjo, March 25, 1979 (J. G. Rozen); Otjiverongo, January 11, February, 1920; 27 km south Okahandja, February 17, 1977 (J. G. and B. L. Rozen), one female on Gisekia africana; Grootfontein; Damarland; Seeheim, February 16-19.

Meganomia gigas Michener new species
(Figs. 55-57, 59, 194)

Meganomia binghami: Rozen, 1977, p. 1-14 (misidentification).

Diagnosis. This is the largest known melittid. It closely resembles M. binghami but is larger, with more extensive, pale yellow maculations, without a hind coxal tooth in the male.

Description. Agrees with description of M. binghami except as follows: Male: Length 17-21 mm; forewing length 12-13 mm. Structure. 1. Produced median lobe (truncation) of clypeal margin less than one third as wide as clypeus. 3. Apex of mandible with lower tooth (apex of rutellum) markedly exceeding upper tooth (apex of pollex). 5. Median flagellar segments somewhat longer than in M. binghami, so that segment 5 is somewhat longer than broad. 6. Front coxal process convex, narrowly rounded at apex. 8. Hind coxa without preapical tooth, its under surface being at same level as that of trochanter. 9. Hind femur about twice as long as broad in side view. 10. Hind tibia viewed from inner side with prominence on anterior margin distinctly beyond middle (this is the more distal prominence seen from outer side). 13. Hind basitarsus with outer basal ridge less high than in M. binghami, abruptly reduced (at an obtuse angle) to more shallowly excavated median part of basitarsus. 16. Apical lobes of sternum VI less broadly rounded than in M. binghami. Coloration. Yellow of scutellum expanded forward on each side of middle (but not at extreme sides) so that at point of maximum, yellow area occupies two thirds to five sixths of scutellar length; under surface of front coxa without or with only patches of yellow; front and middle trochanters with black basal areas, femora with black on posterior surfaces, tibiae with black on under and commonly posterior surfaces; hind trochanter largely black, under side of hind femur black, continued onto entire posterior surface and joining black of upper side; outer surface of hind tibia yellow with apical and median dark spot, inner surface with base and distal half black, this black extending onto lower surface; yellow of metasomal bands pale like that of rest of body, bands broad, unbroken, gradually narrowed medially except that on VI which has median notch in anterior margin, only that of first and sometimes second tergum with shallow sublateral emarginations on posterior margins. Posterior half of tegula translucent testaceous. Pubescence. Hairs on under sides of hind tibiae and tarsi fuscous coppery, almost black in certain lights. Female: Length 17-22 mm; forewing length 13-14 mm. Structure. Inner orbits slightly diverging so that clypeal width is slightly greater than upper interorbital distance. Coloration. Clypeus entirely yellow or with only small pair of black in-

trusions on upper margin; lateral face mark continued upward medially as slender line often joining small spot lateral to median ocellus, this spot sometimes connected by a streak across ocellar triangle to mesal small spot (sometimes absent) on posterior edge of vertex; lateral small spot on posterior edge of vertex often present; stipes black; yellow of pronotum broader than in *M. binghami* and including almost entire lobe; yellow of notaulus extending back as slender streak one-third to five-sixths length of scutum, streak sometimes enlarged at posterior end; large area lateral to anterior end of notaulus and sometimes extending to tegula yellow; axilla, scutellum, and metanotum entirely yellow; pair of spots on posterior surface of propodeum usually present and large; basal yellow of middle tibia occupying nearly half of outer surface; bands on metasomal terga broad and unbroken, notch in band of tergum V often absent.

Type material. Holotype male and allotype female: 62 km west of Omaruru, Namibia (South West Africa), March 25, 1976 (J. G. and B. L. Rozen), in the American Museum of Natural History.

Paratypes (all from Namibia): 37 males and 9 females (one pair pinned together and presumably taken mating), same data as holotype; 6 females and 1 male, 61 km west of Omaruru, March 22, 1979 (J. G. Rozen); 4 females, 60 km west of Omaruru, March 25, 1976 (J. G. and B. L. Rozen); 2 males, 11 females, 58 km southwest of Omaruru, March 26, 1976 (J. G. and B. L. Rozen); 1 male, 58 km west of Omaruru, March 15, 1979 (J. G. and B. L. Rozen); 10 females and 5 males, 52 km west of Omaruru, March 26 and 27, 1976 (J. G. and B. L. Rozen); 5 males and 2 females, 26 km north of Karibib, March 22, 1976, on *Crotalaria podocarpa* (J. G. and B. L. Rozen); 7 males and 3 females, 8 km north of Karibib, March 22, 1976, on *Crotalaria podocarpa* (J. G. and B. L. Rozen); 1 female, 38 km north of Usakos, March 26, 1976 (J. G. and B. L. Rozen); 3 females, 24 males, 17-19 km east of Usakos, March 18, 19, and 22, 1976 (J. G. and B. L. Rozen); 1 male, 11 km west of Usakos, March 6, 1977 (J. G. Rozen). Seven paratypes are in the Snow Entomological Museum, University of Kansas, and four are in the British Museum (Natural History). The rest are in the American Museum of Natural History.

Comments. Many attributes of the biology of this species were described by Rozen (1977). Of special interest is its sound production.

Etymology. The specific name is the Greek noun in apposition, *gigas*, meaning giant, applied because this is the largest melittid.

Meganomia andersoni (Meade-Waldo)
(Figs. 13, 37-41, 51, 52, 59, 196)

Nomia (*Meganomia*) *andersoni* Meade-Waldo, 1916, p. 457.

Meganomia andersoni: Cockerell, 1931a, p. 201; Stage, 1971, p. 312.

Diagnosis. This species and *M. rossi* are easily distinguished from the others by the male antennae, the last three segments of which are much more slender than the preceding segments; also the posteroventral surface of the front tarsus bears a brush of long black hairs. Females have yellow lateral mesoscutel margins. From *M. rossi* this species can be distinguished by the lack of a strong concavity in the anterior margin of the hind tibia of the male and the only moderately shortened ter-

minal antennal segment of the female, this segment being conspicuously longer than broad.

Description. Male: Length 18-19 mm; forewing length 11-11.5 mm.

Structure. 1. Produced median lobe of clypeal apex one third as wide as clypeus, apex rounded. 2. Frontal carina below antennal bases straight seen in profile. 3. Apex of mandible with rutellum markedly exceeding pollex; upper margin of mandible with gentle median convexity. 4. Labrum less than twice as wide as long, surface strongly concave, apex rounded. 5. Flagellum crenulate beneath, particularly on segments 2 to 8; segment 1 less than 2.5 times as long as broad; segments 2-4 about as broad as long or somewhat broader, segments 5 to 9 progressively shorter; segments 2 to 7 of approximately equal width, 8 to 11 progressively narrowed, the last three often curled, 8 broader than long and not greatly narrower than 7, segment 10 over 1.5 times as long as broad, segment 11 curved and pointed (without a broad base as in *M. binghami* and *gigas*). 6. Front coxa not or scarcely projecting behind base of trochanter. 7. Middle coxa with weakly elevated cap in front of base of trochanter. 8. Hind coxa unmodified, its lower surface on level with base of trochanter. 9. Hind femur more than twice as long as broad in side view. 10. Hind tibia viewed from inner side with neither strong prominence nor strong emargination on anterior margin, but with gentle convexity beyond middle. 11. Hind tibia viewed from outer side without emargination in anterior margin, apex with strongly projecting lobe (longer than broad, curled mesad at apex) on anterior half. 12. Front basitarsus with longest hairs on posteroventral surface, these (black) hairs grading into somewhat shorter (white) hairs on rest of under surface; other basitarsal hairs much shorter. 13. Hind basitarsus with outer ridge not strongly elevated at base and not abruptly reduced or excavated; mediotarsal segments less than twice as long as broad. 14. Basal vein of forewing interstitial with or slightly basal to cu-v and less than five times as long as first abscissa of Rs. 15. Metasomal sternum IV without tubercles on disc; V with one short apical black comb borne on apex of a basally broadened median part of sternum; margin lateral to comb simple; base of sternum with two well-defined, invaginated, membranous areas. 16. Apical lobes of sternum VI about as long as wide, subtruncate at apices; apicolateral angle sharp, recurved, not bifid. 17. Apex of gonocoxite without diagonal row of bristles. 18. Penis valves united only by scarcely sclerotized material. 19. Volsella greatly reduced, scarcely projecting beyond margin of gonocoxite.

Coloration. Black, yellow markings of head and thorax (pale yellow on head, otherwise bright yellow) differing from those of *M. binghami* as follows: vertical yellow streak between antennae sometimes not joined to yellow of supraclypeal area; lateral face mark extended up as narrow point along eye margin to level of anterior ocellus; pedicel and sometimes base of flagellar segment 1 black; narrow yellow line along lower half of posterior orbit commonly absent; yellow area on upper half of genal area present but often very reduced; stipes black; pronotal yellow absent below lobe; scutellum and metanotum black. Legs yellow with black as follows: upper parts of coxae (more extensive on front coxa), upper side of front trochanter, basal two thirds of front femur except beneath, spots on anterior and under surfaces of front tibia and area on posterior and under surfaces of mid tibia, posterior and upper surfaces of hind femur (extending down on anterior surface medially), extreme base and distal half of inner surface of hind

tibia, postmedian area on outer surface of hind tibia, hind tarsus except yellow areas on anterior surfaces of all segments, claws except brown bases. Metasoma with yellow bands as in M. binghami but all interrupted medially except on tergum VI, on I merely a large spot on each side, on subsequent terga interruption progressively narrower, on V band sometimes almost continuous; band of tergum VI with median notch on anterior margin. Sternum I with large yellow patch. Sterna II and III largely yellow, the yellow more or less divided by black medially and enclosing oval black spot on each side of each sternum. Sternum IV with lateral yellow spot and spot on either side of midline. Flagellar segments 1-7 blackish above, brownish yellow below; 8-11 yellow, dark along upper edge and at apex of 11. Posterior half of tegula translucent testaceous. Wing coloration as in M. binghami. Pubescence. Coloration as in M. binghami but with rather long, strikingly white hairs on hypostomal area, front coxa, posterior sides of front trochanter and femur, and anteroventral part of front basitarsus; front basitarsus with dense brush of long black hairs along posteroventral surface; other front tarsal segments with ventral hairs black; small segments of middle tarsus with dusky hairs ventrally; hind tarsus with ventral hairs dusky to black, grading to coppery at base of basitarsus. Punctuation. Similar to that of M. binghami but on thorax and metasoma slightly coarser with ground between punctures smoother and more shining. Female: Length 14-17 mm; forewing length 10.5-12 mm. Structure. Labrum over twice as wide as long, apex rounded. Last antennal segment longer than broad. Inner orbits slightly diverging both above and below. Front coxal process broadly rounded at apex, extending but little behind posterior margin of base of trochanter. Wing venation as in male. Coloration. Black, bright yellow markings differing from those of M. binghami as follows: clypeus with median black area extending to apical margin, sometimes enclosing small yellow area; supraclypeal area black or with small yellow spot; lateral face mark with truncation not or but little sloping upward toward median ocellus; scape black; stipes black; dorsal part and lobe of pronotum with more yellow but no yellow below lobe; yellow stripe along notaulus extending almost to posterior margin of scutum; yellow lateral to front of notaulus extending back along lateral scutal margin as far as posterior end of tegula; axilla yellow; scutellum with yellow lateral patches joined or nearly so by narrow posterior marginal band; metanotum yellow at sides and with pair of small spots or small band medially; broad, unbroken yellow band occupying dorsum of propodeal triangle; no yellow on posterior surface of propodeum; small to extensive yellow areas on upper posterior part of mesepisternum and upper part to almost whole metepisternum; upper side of front tibia mostly yellow or yellow narrowed medially by black intrusions from anterior and posterior margins, underside black; middle tibia with basal half to fourth of upper side yellow, this area often continued but narrowed toward apex of tibia, also spot on anterior side of apex of mid tibia; upper side of last anterior tarsal segment yellow; band of metasomal tergum I broken, that of II sometimes broken; sublateral emarginations on posterior margins of bands usually unrecognizable. Coloration otherwise as described for M. binghami. Pubescence. As described for M. binghami but prepygidial fimbria reddish dusky; no fuscous hairs around apex of basitibial plate. Punctuation. As described for M. binghami but mesoscutal punctuation coarser and sparser medially, large mesoscutal punctures as large as those of scutellum; depressed marginal

zones of metasomal terga with scattered small punctures and hairs.

Type material. The type, a male, from the Masai Reserve in southern Kenya is in the British Museum (Natural History).

Distribution. Arid parts of southern Kenya. Aside from the type, the species is known from a series of both sexes from 8 miles (13 km) northeast of Magadi, Kenya, 2500 feet (760 m) altitude, June 16, 1967 (C. D. Michener) and one female from 20 miles (32 km) northeast of Magadi, 3500 feet (1070 m) altitude, June 16, 1967 (C. D. Michener).

Meganomia (Meganomia) rossi Michener new species
(Figs. 42-46, 49, 50, 59, 195)

Diagnosis. This species differs from its close relative, *M. andersoni*, in having a strong concavity on the anterior margin of the hind tibia of the male and in the very short last antennal segment of the female, this segment being not or scarcely longer than broad.

Description. Agrees with description of *M. andersoni* except as follows: Male: Structure. 3. Upper margin of mandible with strong postmedian protruding convexity. 4. Apex of labrum broadly truncate. 5. Flagellar segment 8 longer than and less than two thirds as wide as preceding segments, longer than broad, thus part of attenuate apex of antenna; segment 10 twice as long as broad; segment 11 curved, finger-shaped and rounded at apex in side view, pointed in ventral view, more slender than in *M. andersoni*. 10. Hind tibia viewed from inner side with large declivity toward emargination on anterior margin, without gentle convexity. 11. Hind tibia viewed from outer side with large emargination in apical half of anterior margin; apex with strong projecting lobe on anterior half, distal part turned mesad and extending farther in that direction than basal part extends distad from apex of tibia. 12. Front basitarsus with brassy hairs on anterior margin even longer than black hairs on posteroventral surface. 13. Hind mediotarsal segments about twice as long as broad. 14. Basal vein of forewing interstitial with or slightly distal to cu-v. 15. Metasomal sternum IV with high, sharp tubercle rising from disc mediolaterally; V with part bearing median comb slender, parallel-sided; apical margin lateral to comb with shoulder near comb so that comb sits in a small emargination; base of V without invaginated membranous areas; lateral fringes longer than in *M. andersoni*. 16. Lobes of sternum VI longer than wide, subtruncate at apices; apicolateral angle produced to long slender, deeply bifid process. Coloration. Yellow of face as bright as that elsewhere; yellow of supraclypeal area sometimes reduced to spot, connected to streak between antennae which continues up to median ocellus, narrow yellow line along lower half of posterior orbit present in both specimens; scutum with yellow reduced to small streak near anterior end of notaulus; axilla and extreme lateral area on metanotum yellow; front femur black except for yellow stripe on under side connected around anterior side of apex of femur to large yellow spot on apex of upper side; large black area on upper side of middle femur; black areas on outer sides of front and middle tibiae; yellow absent on hind basitarsus and nearly so on mediotarsal segments; metasomal sterna brown, III and IV yellowish lateroapically. Flagellar segments 8 and 9 yellowish brown along upper edges, 10 entirely yellow, 11 entirely brown. Pubescence. Scutal and scutellar pubescence shorter than in *M. andersoni*, ochreous;

small segments of middle and hind tarsi with ventral hairs brown; hind basitarsus more hairy than in *M. andersoni* with broad band of black hairs on underside from base to apex. Female: Structure. Labrum about three times as wide as long, apex broadly, shallowly emarginate. Apex of antenna even more shortened than usual in the genus, last antennal segment only about as long as broad. Coloration. Lateral face marks fused above antennae and extending up medially as a band surrounding median ocellus and continued between lateral ocelli to posterior margin of vertex; yellow spot on margin of vertex mesal to summit of eye; scape black or partly yellow beneath; yellow lateral patches on scutellum not joined; metanotum largely yellow; large yellow spot on each side of posterior surface of propodeum; mesepisternum black; metepisternum black or with small yellow area along upper end; yellow of legs limited to small spots on outer bases of fore and mid tibiae and areas on all distitarsi; bands of metasomal terga I to III broken medially. Pubescence. Hairs of scutum and scutellum shorter, sparser, and more ochreous than in *M. andersoni*. Hairs on basitibial plate dusky; scopal hairs beyond basitibial plate along upper tibial margin dusky; prepygidial fimbria except apical margin and pygidial fimbria dusky. Punctuation. Mesoscutum and scutellum except margins and except for anterior and lateral parts of mesoscutum shining with only small and widely separated punctures; depressed marginal zones of metasomal terga almost without punctures and hairs.

Type material. Holotype male, allotype female, and 1 male and 1 female paratype: Kitani Lodge, Tsavo National Park, Kenya, 2600 feet (790 m) altitude, December 29, 1969 (M. E. Irwin, E. S. Ross), in the California Academy of Sciences.

Etymology. This species is named after Dr. E. S. Ross of the California Academy of Sciences in recognition of his extensive worldwide collecting.

Comment. I am indebted to Dr. G. I. Stage who had borrowed the specimens from the California Academy of Sciences for the opportunity to study this species.

APPENDIX II. NEW AND LITTLE KNOWN SPECIES OF MELITTINAE
AND DASYPODINAE

The following new species are described because the names were needed in the treatment of genera in the body of this work. Notes are also added concerning certain previously described species.

Melitta californica Viereck

Melitta (*Brachycephalapis*) *californica* Viereck, 1909, p. 47.

Melitta wilmattae Cockerell, 1937, p. 3 (new synonymy).

Melitta maritima Cockerell, 1941, p. 344 (new synonymy).

I have compared the type of *M. californica* kindly lent by Dr. D. H. Kavanaugh of the California Academy of Sciences, and the type of *M. maritima* lent by Dr. J. Hall of the University of California at Riverside with specimens from near the type locality of *M. wilmattae*; they are the same species, a conclusion earlier and independently reached by Dr. G. I. Stage. In describing *M. wilmattae*, Cockerell emphasized propodeal differences which are trivial and vary among specimens, and the lack of black hairs along the sides of the face of the female. It is true that the type of *californica* (as well as that of *maritima*) has scattered blackish hairs down to the level of the lower ends of the eyes; such hairs are said to be absent in the type of *M. wilmattae*. In a female from Glamis such hairs extend down about to the middle of the eye. The type of *M. maritima* lacked pale apical hair bands on the metasomal terga, except for lateral remnants on the second tergum. The specimen was, however, extremely worn, with wings badly tattered, and the hair bands were obviously worn off.

The range of the species is probably mostly in Mexico and is separated by perhaps 2000 km from that of its geographically nearest congener, *M. americana* Smith of the eastern United States. The known localities are as follows: Baja California Sur: Isla de Santa Margarita, March (type of *M. californica*). Baja California Norte: Ensenada, April 13, 1941 (type of *M. maritima*). Arizona: Dublin, near Yuma, March 8, 1937 (type of *M. wilmattae*). California: 3 miles (5 km) northwest of Glamis, Imperial County, March 4, 1972 (E. A. Kane, in collection of R. W. Brooks).

The type of *M. wilmattae* and the specimens from Glamis were taken on flowers of *Sphaeralcea*; it is possible that the species is restricted to that plant as a pollen source.

The holotype of *M. californica* is in the California Academy of Sciences, San Francisco. The paratype, in the U. S. National Museum according to Viereck, is not there (P. D. Hurd, personal communication). The holotype of *M. wilmattae* is in the American Museum of Natural History, New York. The type of *M. maritima* was in the Timberlake Collection at the University of California at Riverside. It was lost in the mail after I examined it.

Redivivoides simulans Michener new species
(Figs. 80, 82-84, 97)

Diagnosis. Rather large melittine, usually with reddish-testaceous areas on basal metasomal terga; hind tibia and basitarsus of female slender with scopal hairs on outer surfaces short and simple; tergum VII of male with weak but distinct pygidial plate. Differs from superficially similar *Melitta capensis* Friese and *Rediviva rufocincta* (Cockerell) by generic characters including those listed above.

Description. Female: Length 13 mm (12.5-15 mm among paratypes); wing length 9 mm (varying to 8.5 mm). Structure. Inner orbits parallel, upper parts somewhat converging so that eyes are closest near upper ends; face broad, minimum interocular distance about equal to length of eye; malar area short but distinct, over three times as broad as long; genal area as wide as eye seen from side; distance between posterior ocelli slightly less than ocellocular distance; ocelloccipital distance less than ocellar diameter; flagellar segment 1 over half as long as scape (excluding basal bulb), 2 broader than long, others longer than broad and subequal in length except for 10 which is over twice as long as broad. Anterior basitarsus shaped as in *Melitta*, about as long as segments 2-5 together which are not unusually robust or densely haired as in *Rediviva*. Second submarginal cell considerably longer than broad, receiving first recurrent vein in middle; third submarginal cell receiving second recurrent vein beyond middle. Pygidial plate rounded at apex, discal part coarsely transversely rugose. Coloration. Head and thorax black, apical portions of mandible, tarsi and to a lesser extent femora and tibiae, and tegula rufescent; under side of flagellum red brown, upper side brownish black. Wings light yellowish brown, veins and stigma brown. Metasoma black; posterior margins of terga I-IV broadly yellowish transparent, of sterna I-IV more narrowly reddish translucent; following other areas pale red or reddish testaceous: tergum I, tergum II except median basal area and lateral spot, broad band across tergum III just basal to transparent marginal band, sterna I (blackish basally) and II, basal parts of sterna III and IV. (In some paratypes these areas variously reduced, the darkest having reddish only as follows: tergum I, dorsal sublateral areas on tergum II, preapical band on sternum II, and weakly developed on bases of terga III and IV.) Pubescence. Rather abundant, yellowish white, ochraceous on dorsum of head and thorax, forming broad bands of somewhat appressed, short, plumose hairs on posterior transparent margins of terga I-IV, that on I with hairs rather sparse, the following areas with darker hairs: clypeus, labrum and mandible with yellowish dusky hairs, some hairs dusky in some lights; lateral margin of paraocular area, next to eye, with hairs black; vertex with hairs black to dusky; margin of genal area behind eye with long black hairs intermixed with paler ones; scutum with intermixed dusky hairs; outer sides of tibiae and basitarsi with hairs dusky, black in certain lights, grading into the reddish-yellow hairs of inner sides of tibiae and tarsi; metasomal terga II to IV with short, erect, black or dusky hairs in front of transparent marginal bands; terga V and VI with abundant black hair, small area of whitish hairs at extreme sides of V; sterna III and following with hairs of discs dusky (varying to yellowish), posterior marginal hairs of III and IV pale. Punctuation. Labrum impunctate, shining, except for broad, punctate, hairy apical band; clypeus shining, strongly punctate except for broad

apical, largely nonpunctate band; rest of face shining, punctures finer than on clypeus and progressively finer upward; genal area still more finely and rather closely punctate; mesoscutum finely and closely punctate anteriorly, progressively more shining and more coarsely punctate posteriorly and on scutellum, which has punctures similar in size to those of middle of face and mesepisternum; metepisternum with lower half impunctate, upper half with minute punctures; propodeum shining with punctures finer anteriorly, coarser posteriorly, absent on small, smooth undefined triangle; metasomal terga and sterna shining with well separated punctures, finer on posterior marginal zones than elsewhere, coarser on posterior than on anterior terga, margins proper narrowly impunctate. Male: Length 11.5 mm (10.5-12 mm among paratypes); wing length 8.5 mm (8-9 mm among paratypes). Agrees with description of female except as follows: Structure. Inner orbits slightly converging below. Distance between posterior ocelli equal to ocellocular distance. Flagellar segment 1 over half as long as scape (excluding basal bulb), 2 about 1.5 times as long as broad, others about as long as 1, nearly twice as long as broad, except 11 which is over twice as long as broad. Pygidial plate weakly defined, obtusely angulate at apex. Coloration. Tibiae and tarsi often paler than in female, hind tibia and tarsus often red brown. Posterior margins of metasomal terga and sterna I-V yellowish transparent, more broadly so on terga. Tergum II with black continuous across base of tergum, or in some paratypes this tergum almost entirely yellowish red, in others black limited to median basal area, in others with black lateral spot also. Sternum III and sometimes most of IV pale red. Pubescence. Whiter (i.e., less yellowish) than in female, hairs of apical tergal bands longer than in female, and on transparent margins of terga I-V, that on I with hairs rather sparse; hairs of clypeus white; scutellum with intermixed dusky hairs like scutum; outer sides of tibiae and basitarsi with hairs whitish; terga II-V with black hairs in front of marginal bands, VI and VII with hairs dusky; sterna with hairs yellowish white except for VI which has dusky hairs, sterna II-V with apical paler fringes of longer hairs. Punctuation. Areas less distinctive than in female, so that punctuation of clypeus is not much coarser than that of supraclypeal area, that of genal area and front part of mesoscutum is not so fine as in female, that of posterior part of mesoscutum and scutellum finer than in female, not much coarser than that of anterior part of mesoscutum.

Type material. Holotype female, allotype male, and 14 female and 15 male paratypes, South Africa: Clanwilliam, Cape Province, 6 September 1966 (M. and C. D. Michener); 1 female and 3 male paratypes, 20 miles (32 km) west of Clanwilliam, 16 September 1966 (C. D. Michener). The holotype and allotype are in the Snow Entomological Museum, University of Kansas. Paratypes are in that collection, the American Museum of Natural History (New York), the National Museum of Natural History (Washington) and the British Museum (Natural History).

Etymology. The specific name refers to the similarity of this species to other somewhat distantly related Melittinae, as indicated in the diagnosis.

Rediviva peringueyi (Friese)
(Figs. 85-87, 95)

Andrena (Rediviva) peringueyi Friese, 1911, p. 671.

This is the type species of the genus. The female has elongate front legs, but not nearly so extreme as in *R. longimanus*, the front tibia being only about as long as the eye.

One of Friese's original female specimens from Stellenbosch and a male from Cape Town are in the South African Museum, Cape Town. The female type from Paarl is in Berlin. An additional record is a single female from Clanwilliam, 8 September 1966 (M. and C. D. Michener). All these localities are in western Cape Province, South Africa.

Rediviva longimanus Michener new species
(Figs. 96, 97)

Diagnosis. Black with pubescence mostly black except on legs; front legs of female extraordinarily long and slender (Fig. 96). The closest relative is probably *R. peringueyi*, from which *R. longimanus* differs in both features mentioned above.

Description. Female: Length 14 mm; wing length 10.5 mm. Structure. Inner orbits parallel, upper parts converging above so that eyes are closest near upper ends; face moderately broad, minimum interocular distance less than length of eye; malar area short, about five times as broad as long; face not especially protuberant, apex of clypeus in side view in front of anterior eye margin by about eye width; genal area as wide as eye seen from side; distance between posterior ocelli less than ocellocular distance; ocelloccipital distance about equal to ocellar diameter; flagellar segment 1 fully half as long as scape (excluding basal bulb), 2 broader than long, 3 as broad as long, others longer than broad. Anterior legs extremely attenuate (Fig. 96), tibia about 1.5 times as long as eye; small segments of tarsus, except for under sides, densely covered with short, dense, plumose hairs. Second submarginal cell considerably longer than broad, receiving first recurrent vein in middle; third submarginal cell receiving second recurrent vein beyond middle; basal vein over twice as long as first abscissa of Rs, interstitial with cu-v; wings badly worn but jugal lobe apparently slightly less than half as long as vannal. Propodeal triangle weakly defined, about one third as wide as distance between transmetanotal sutures. Pygidial plate subtruncate, smooth but dull. Coloration. Black, tegula and small segments of mid and hind tarsi reddish; under sides of third and following flagellar segments brown. Wings strongly dusky, veins and stigma black. Pubescence. Black except as indicated below, sparse and short on dorsum of metasoma which completely lacks hair bands. Hair of labrum, lower margin of mandible, under side of thorax, coxae, trochanters, apical fringe of tergum V, and metasomal sterna I-V dusky coppery, apical fringes on sterna II-V long and conspicuous; hairs of tibiae, tarsi, and tergum VI golden. Punctuation. Labrum impunctate except for apical punctate hairy zone; clypeus with moderate sized punctures separated by about a puncture width except for lower third which is largely impunctate, surface between punctures shining but minutely roughened; supraclypeal and lower paraocular areas similar to clypeus

but punctures slightly smaller; frons with punctures of same size but denser, surface duller because of minute roughening; upper part of head and genal areas with punctures small, ground between them rather dull in most areas; shiny and nearly impunctate areas below antennal base and lateral to posterior ocellus; scutum and scutellum with punctures fine, finest and ground dull on anterior third of scutum; mesepisternum with punctures shallow, well separated, ground dull; metepisternum shining, impunctate; propodeum with punctures minute, widely separated, coarser and closer on anterior lateral portions, ground somewhat shining, triangle shining, minutely transversely wrinkled; metasomal terga shining, broad apical zones minutely roughened but ground in front of apical bands smooth or nearly so, punctures minute and widely separated dorsally, coarser and closer laterally and on IV and especially V. Sterna more coarsely punctate, ground between punctures minutely roughened, especially on posterior segments.

Type material. Holotype female: South Africa: 5 miles (8 km) north of Nieuwoudtville, Cape Province, September, 1961, in the South African Museum, Cape Town.

Etymology. From the Latin longus, long, plus manus, hand, with reference to the long front tarsi. It is a noun in apposition and hence not in agreement with the feminine generic name.

Comments. This species is described here from the single known specimen because it represents the extreme in elongation of the front legs of the female. Probably this relates to oil-collecting habits from some specific kind of flower.

A single female specimen without data in the South African Museum is morphologically like R. longimanus but has paler wings and pubescence, in general like that of R. peringueyi but without the weak apical hair bands on the terga found in that species. It may represent a color morph of longimanus or a related species.

Rediviva colorata Michener new species
(Figs. 88-91, 94, 97)

Diagnosis. Black with red-brown areas on basal metasomal terga; metasomal terga I-III of male, I-IV of female, with apical bands of yellow hairs; head longer than broad, clypeus strongly produced and protuberant, malar area over half (female) to about three fourths (male) as long as broad; second submarginal cell about as long as broad. Superficially similar to R. rufocincta (Cockerell) but differing in long face, long tongue, slender front legs of the female, dull facial integument, and many other characters.

Description. Female: Length 12.5 mm; wing length 10 mm. Structure. Inner orbits slightly converging below except for upper parts which converge above; distance between eyes less than length of eye; malar area over half as long as wide; face longer than wide, clypeus protuberant so that in side view anterior end is in front of anterior eye margin by distance much greater than eye width; glossa slender, more than half as long as the head and over half as long as prementum; galeal blade blunt, about 3.5 times as long as broad; genal area as wide as eye seen from side; distance between posterior ocelli slightly less than ocellocular distance; ocelloccipital distance greater than ocellar diameter; flagellar segment 1 less than half as long as scape (excluding

basal bulb), 2 and 3 equal in length, each broader than long, 4 as long as broad, 5-9 the same or slightly longer than broad, depending on antennal curvature, 10 nearly twice as long as broad. Anterior leg slender, tibia slightly longer than eye, tarsus not especially elongate (Fig. 94), small segments densely covered with plumose hairs except on underside. Second submarginal cell about as long as wide, receiving first recurrent vein at apical fourth; third submarginal cell receiving second recurrent vein near beginning of apical third; basal vein much over twice as long as first abscissa of Rs, fractionally basal to (or interstitial with) cu-v; jugal lobe little over one-third length of vannal lobe. Propodeal triangle minute, less than one sixth as wide as distance between transmetanotal sutures. Pygidial plate rounded at apex, disc closely punctate. Coloration. Black, tegula, dorsal surface of metasomal tergum I, lateral portions of II and III, and base of sternum II yellowish brown; anterior surface of tergum I dark brown; small segments of tarsi and under side of flagellum brown; posterior margins of metasomal terga I to IV and sterna I to V broadly yellowish transparent, with some yellow brown at bases of transparent zones; mandible with distal half rufescent. Wings light brown, veins and stigma dark brown, vein R of forewing black. Pubescence. Ochraceous, paler on under side than elsewhere, apical bands of rather long recumbent yellow hairs on metasomal terga I to IV, apical bands of more erect, very long, pallid hairs on sterna II to V; hairs of labrum, mandible, tibiae and tarsi golden; black hairs intermixed with pale ones on face, vertex, along posterior orbit, on scutum and scutellum; front tibia and tarsus with hairs dusky gold on anterior surfaces; mid tibia and basitarsus with hairs dusky gold on posterior surfaces; apical part of tibial scopa with long simple hairs of posterior portion dusky gold to black, basitarsus with similar dark simple hairs on posterior and distal parts; parted hairs of basitarsal apex dusky; metasomal tergum IV with a few intermixed black hairs basally; pubescence of terga V and VI and sternum VI black. Punctuation. Labrum shining impunctate except for apical, punctate, hairy zone; clypeus coarsely punctate, more coarsely and irregularly so apically, ground between punctures mostly less than a puncture width and rather dull, minutely roughened; rest of face progressively more finely punctate upward to vertex, ground rather dull with fine roughening; malar area largely shining, impunctate; genal area shining with scattered punctures; scutum and scutellum dull with punctures mostly coarser than those of vertex and separated by a puncture width or more, finer and closer on small posterior discal area of scutum; mesepisternum shining with coarse, shallow punctures; metepisternum shining, lower half impunctate, upper half with minute punctures; propodeum rather dull with irregular and rather shallow punctures except minute, smooth, shining propodeal triangle; metasomal terga smooth, shining, punctures minute and widely separated, little coarser on tergum V; apical margins of terga impunctate; sterna minutely roughened with well separated punctures, coarser than those of terga except on sternum VI. Male: Length 12 mm; wing length 10 mm. Similar to description of female except as follows: Structure. Inner orbits slightly converging below except for upper extremities which converge above; malar area nearly three fourths as long as wide; genal area slightly narrower than eye seen from side; flagellar segment 2 slightly longer than wide, 3-10 subequal in length, about 1.3-1.4 times as long as wide, 11 about twice as long as wide. Anterior leg unmodified. Py-

gidial plate absent. Tergum VIII without membranous lobe lateral to bifurcate apex. (Other known Rediviva all have such a lobe.) Coloration. Flagellum entirely blackish; metasomal terga IV-VI with posterior margins translucent brownish black, only I-III yellowish transparent. Pubescence. Apical bands of rather long yellow hair only on terga I-III and extreme sides of IV; hair of sterna shorter than in female and not forming conspicuous bands; tibiae and tarsi with yellow hairs, dark only on apical three fifths of hind basitarsus; metasomal tergum III with a few intermixed dusky hairs on disk; terga IV-VII and sternum VI with hairs black, yellow only on extreme side of IV. Punctuation. Clypeus somewhat more finely punctate than in female, about like supraclypeal area; scutum and scutellum with punctures small, widely separated.

Type material. Holotype female, allotype male, and 1 male paratype: South Africa: Karkloof, Natal, February 15, 1942 (Markley). The holotype and allotype are placed in the British Museum (Natural History). The paratype is in the Snow Entomological Museum, University of Kansas.

Etymology: From coloratus, colored or variegated, from the variety of integumental and hair colors of this species.

Haplomelitta (Prosamba) griseonigra Michener new species
(Figs. 107, 108, 116-121, 147, 148)

Diagnosis. The only known species of Prosamba, therefore recognized by diagnostic characters of that subgenus (or genus). Similar robust form, dark coloration and lack of metasomal fasciae to H. (Atrosamba) atra from which it differs in much smaller size as well as the subgeneric characters. Similar in size and body form to H. (Metasamba) fasciata from which it differs by darker pubescence and lack of metasomal fasciae, as well as subgeneric characters.

Description. Female: Length 8 mm; forewing length 5.5 mm. Structure. Inner orbits scarcely converging below, minimum distance between eyes slightly greater than length of eye; malar area short, as long as median width of flagellar segment 1 medially, but anterior mandibular articulation well separated from eye margin; genal area wider than eye seen from side; distance between posterior ocelli scarcely less than ocellocular distance; ocelloccipital distance slightly greater than ocellar diameter; flagellar segment 1 distinctly less than half as long as scape (excluding basal bulb), 2-10 progressively broader, 2-9 broader than long or sometimes 2 seeming about as long as broad, 10 about 1.5 times as long as broad. Coloration. Black; distal half of mandible red, legs and tegula reddish black; underside of flagellar segments 3-10 light brown, rest of antenna dark brown to reddish black; posterior depressed margins of metasomal terga I-IV translucent reddish black; pygidial plate partly red in some paratypes. Tibial spurs translucent whitish brown. Wings brown, veins and stigma dark brown. Pubescence. Sparse, brownish, dense white patch obscuring surface lateral to antennal base and more white hairs immediately above antennal bases; erect white hairs at sides of terga I-IV, with some shorter white hairs arising dorsad on basal parts of terga; dull whitish or pale hairs on posterior part of vertex, anterior margin of scutum, lateral extremities of scutellum and metanotum, lateral surface of mesepisternum; black or

fuscous hairs on mandible, lower clypeal margin, paraocular area along eye margin, genal area, anterior surface of mesepisternum, lateral surface of propodeum, most of legs (scopa entirely blackish), and metasoma (prepygidial and pygidial fimbriae dense and black); black or fuscous hairs intermixed with paler ones on scape, ocellar region, and dorsal parts of terga II-IV; under sides of tarsi with orange hair; hair bands of terga I-IV entirely absent. Punctuation. Labrum shining, impunctate, except punctured beyond transverse ridge; clypeus shining, impunctate except for scattered coarse punctures laterally and near upper margin; supraclypeal area with longitudinal median impunctate zone; rest of face strongly and rather densely punctate, a little more finely so upward, intervals between punctures much less than puncture diameters, shining; area lateral to ocelli, extending to upper genal area beyond eye, impunctate; scutum more coarsely punctate than head, ground smooth and shining, punctures mostly separated by less than a puncture width anteriorly, but posterior median area with interspaces mostly of several puncture widths; mesepisterna, lateral and posterior surfaces of propodeum, and scutellum similar but more finely punctate; propodeal triangle shining but minutely roughened; metasoma with rather coarse punctures on shining ground, basal concavity of tergum I broadly impunctate and shining, terga I-IV each with largely impunctate transverse ridge basal to apical depressed zones, the latter broad, smooth, impunctate. Male: Length 8 mm; forewing length 5.5 mm. Agrees with description of female except as follows: Structure. Inner orbits strongly converging below, minimum distance between eyes less than eye length; genal area narrower than eye seen from side; flagellar segment 1 about half as long as scape, 2-10 of nearly uniform width, 2 broader than long, 3-5 about as broad as long, the remaining segments progressively longer. Coloration. Mandible with preapical red band; undersides of front femur and tibia and base of mid femur, small segments of all tarsi, flagellar segments 3-10 and tegula red. Wings paler than in female, membrane almost clear. Pubescence. Somewhat longer than in female, white, somewhat yellowish on legs, yellowish orange on undersides of tarsi; face densely covered with long, appressed, white hair hiding surface; metasomal terga with rather long, erect (but curved apicad near tips) white hair arising basal to depressed apical zones, these hairs well separated so that surface is easily visible. Punctuation. Clypeus closely and rather finely punctate, like rest of face; impunctate area lateral to ocelli less extensive than in female.

Type material. Holotype female and 4 female paratypes: South Africa: Kamieskroon, Namaqualand, Cape Province, September, 1930 (South African Museum Staff). They are in the South African Museum, Cape Town, except 1 paratype in the Snow Entomological Museum, University of Kansas.

The single male specimen may possibly be a different species since it was taken at a different place. It is therefore not designated as the allotype. It is from Bowesdorp, Namaqualand, September, 1941 (South African Museum Staff).

Etymology. The specific name refers to the grayish black general appearance.

Haplomelitta (Atrosamba) atra Michener new species
(Figs. 109, 110, 122-126, 147, 148)

Diagnosis. The only known species of Atrosamba, therefore recognized by diagnostic characters of that subgenus (or genus). Similar in robust form and dark coloration to H. (Prosamba) griseonigra from which it differs in larger size, more extensive black hairs, as well as subgeneric characters. The body form is also similar to that of H. (Metasamba) fasciata from which it differs by large size, dark pubescence, and lack of metasomal fasciae, as well as subgeneric characters.

Description. Female: Length 11-11.5 mm; forewing length 9 mm. Structure. Inner orbits parallel, distance between eyes greater than length of eye; malar area short, as long as median width of flagellar segment 1 posteriorly, but anterior mandibular articulation far from eye margin; genal area slightly wider than eye seen from side; distance between posterior ocelli less than ocellocular distance; ocelloccipital distance about twice ocellar diameter; flagellar segment 1 distinctly less than half as long as scape (excluding basal bulb), 3-10 of about the same width (flagellum being more slender than in H. griseonigra), 2 broader than long, 3-9 about as long as broad (often appearing either shorter or longer depending on flagellar curvature), 10 about 1.5 times as long as broad. Coloration. Black, mandible with dark red median band, legs extensively dark red, upper surfaces of femora and tibiae reddish black; flagellar segments 3-10 rather dark brown beneath. Tibial spurs dark red brown. Wings brown, veins and stigma dark brown. Pubescence. Not dense, not obscuring surface except for black pygidial and prepygidial fimbriae, short and erect on dorsal surfaces of terga II-IV but elsewhere moderately long, black or brownish black except for yellowish-white hairs on vertex and occiput behind ocelli, posterior lobe and upper (posterior) margin of pronotum, anterior margin of scutum (mixed with black), lateral extremities of scutellum and metanotum, metasomal tergum I, lateral extremities of tergum II; undersides of tarsi, of hind tibia, and of certain areas on other tibiae with orange hair; hair bands of terga I-IV entirely absent. Punctuation. Labrum shining and impunctate on transverse ridge and basal to it; densely punctate distal to ridge; clypeus rather sparsely punctate laterally and near margins but median third except near margins shining, impunctate or with sparse punctures; rest of face strongly and rather densely punctate, intervals between punctures mostly less than half a puncture width and shining; area immediately lateral to lateral ocellus and zone on genal area behind upper end of eye impunctate, but vertex between these areas with punctures, irregularly placed but separated by about a puncture width of shining ground; punctuation of scutum and scutellum about like that of vertex, of mesepisternum denser, of metepisternum and propodeum much finer, rather dense on side of propodeum; propodeal triangle polished; metasomal terga with fine, well separated punctures dorsally, denser and coarser punctures laterally, ground shining; basal concavity of tergum I broadly impunctate; posterior marginal zones of terga I-IV depressed, shining, impunctate, not preceded by shining ridges as in H. griseonigra. Male: Length 10 mm; wing length 7.5 mm. Agrees with description of female except as follows: Structure: Inner orbits converging below; minimum distance between eyes subequal to length of eye; genal area about as wide as eye seen from side; ocelloc-

capital distance about 1.5 ocellar diameters; flagellar segments 3-11 longer than broad. Coloration. Femora and front tibia largely black. Tibial spurs red. Pubescence. Moderately long, including that of metasomal terga; that of clypeus long, appressed, white, obscuring clypeal surface. Pubescence largely yellowish white; black to fuscous on mandible, paraocular area especially laterally, genal area, posterior part of mesepisternum, metepisternum, propodeum, tergum V-VII, and metasomal sterna; black mixed with white on scape, vertex, scutum, scutellum, legs, and tergum IV. Punctuation. Clypeus finely and rather densely punctate; rest of face more coarsely punctate, as in female; terga I-VI with shining depressed marginal zones.

Type material. Holotype female, allotype male, and 2 female paratypes: South Africa: Springbok, Namaqualand, Cape Province, 7 September 1966 (C. D. Michener). Two female paratypes: 5 miles (8 km) north of Nieuwoudtville, Cape Province, September, 1961 (South African Museum). One female paratype: Kamieskroon, Namaqualand, Cape Province, September, 1930 (South African Museum Staff). The holotype and allotype are in the Snow Entomological Museum; paratypes are in that institution and the South African Museum, Cape Town.

One female of the same or a closely related species is from Worcester, Cape Province, 30 September 1966 (C. D. Michener). It is larger than typical *H. atra*, the clypeus punctate almost throughout, tergum I with much intermixed black hair, and tergum II without pale hair. An apparently typical male of *H. atra* is from Ladismith, Cape Province, September 9, 1948 (C. Jacot-Guillarmod).

Etymology. The specific name refers to the largely black color.

Haplomelitta (Haplosamba) tridentata Michener new species (Fig. 147)

Diagnosis. Sparsely hairy, shiny black with the metasoma largely red, superficially resembling *H. (Haplomelitta) ogilviei* (Cockerell), from which it differs in the subgeneric characters.

Description. Female: Length 11.5 mm; forewing length 7.5 mm. Structure. Inner orbits diverging below, minimum distance between eyes equal to length of eye; malar area posteriorly as wide as apex of flagellar segment 1, anterior mandibular articulation far from eye margin; genal area wider than eye seen from side; distance between posterior ocelli much less than ocellocular distance; ocelloccipital distance much greater than ocellar diameter; flagellar segment 1 about one third as long as scape (excluding basal bulb), 2-3 distinctly broader than long, 4-9 slightly so to as long as broad, 10 slightly more than 1.5 times as long as broad, flagellum slightly tapering so that segment 10 is a little broader than 2. Scutellum biconvex. Coloration. Black; mandible, clypeus, genal area, and adjacent parts of head dark red to reddish black; coxae and trochanters largely dark red; rest of legs and scape dark red; tibial spurs red; antennal segments 2-12 brown; tegula and wing base orange; metasomal segments I-III and base of IV and base of pygidial plate red; wings dark brown, veins and stigma dark brown. Pubescence. Short, sparse, nowhere obscuring surface, fuscous to blackish, yellowish intermixed on frons, vertex (hairs of vertex and occiput behind ocelli all yellowish), posterior lobe of pronotum, scutum and scutellum; light fuscous hairs appearing yellowish in some lights on

face, legs, and metasomal venter; scopa reddish fuscous; hairs of under sides of tarsi orange. Punctuation. Labrum shining impunctate except distal marginal zone; clypeus shining, impunctate except for punctate lateral extremities and a few punctures near upper margin; upper part of supraclypeal area and lower part of frons closely punctate but rest of head with punctures well separated by shining ground, lower supraclypeal area, area between ocelli and eye, and genal area with punctures separated by several diameters, elsewhere closer, coarsest on lower paraocular area; central part of scutum, from front to rear, with punctures separated by several puncture widths, on scutellum and on scutum laterally punctures coarser and closer, on sides of thorax still coarser and closer; ground everywhere smooth and shining; propodeal triangle smooth and shining; metasomal terga with punctures laterally and sublaterally coarse and irregular, separated by broad intervals of shining ground, medially punctures finer and sparser so that mid-dorsum of terga I-V is almost impunctate; terga I-IV each with depressed posterior marginal impunctate zone, sharply set off and somewhat narrowed sublaterally by largely impunctate convexity anterior to each depressed band.

Type material. Holotype female: South Africa: Wallekraal, Namaqualand, Cape Province, October, 1950 (South African Museum Expedition). This locality is at 30°25'S, 17°27'E, according to J. G. Rozen, Jr. The type is in the South African Museum, Cape Town.

Etymology. The specific name refers to the tridentate mandibles.

Haplomelitta (*Metasamba*) *fasciata* Michener new species
(Figs. 133-138, 144, 147, 148)

Diagnosis. The only known species of *Metasamba*, therefore recognized by the diagnostic characters of that subgenus (or genus). It is similar in its robust form to *H. (Atrosamba) atra* and *H. (Prosamba) griseonigra* but differs from both in having nearly all of the hair white, and in having white, pubescent fasciae on the metasomal terga.

Description. Female: Length 8.5 to nearly 9 mm; forewing length nearly 6 mm. Structure. Clypeus and supraclypeal area with longitudinal median, elevated ridge; inner orbits converging below, minimum distance between eyes about equal to eye length; malar area medially shorter than basal width of flagellar segment 1, but anterior mandibular articulation well separated from eye margin; genal area as wide as eye seen from side; distance between posterior ocelli less than ocellocular distance; ocellocapital distance little greater than ocellar diameter; flagellar segment 1 little over one fourth as long as scape (excluding basal bulb), segments 2-9 broader than long, 10 about 1.75 times as long as broad; flagellum of uniform width beyond about segment 3. Coloration. Black; mandible with preapical red band; tibiae (except outer sides of fore and middle tibiae and sometimes basitarsi), tibial spurs, tarsi, undersides of flagellar segments 3 to base of 9, tegula and wing base light red; upper side of flagellum and whole of segment 10 dark brown; posterior depressed margins of metasomal terga I-IV transparent testaceous, black showing through from succeeding terga. Wings light brown, stigma and most veins brown. Pubescence. Moderately abundant, long, white, absent on lower two thirds of clypeus except for hairs and bristles along lower clypeal margin (in worn individuals absent below

level of upper margin of clypeus); dense and nearly obscuring surface on much of face above level of upper margin of clypeus; metasomal terga I-IV with preapical bands of plumose hair arising just basal to apical depressed marginal zones which are partly obscured by hair, hair bands broken or weak medially, especially on anterior terga; hairs of tibiae, tarsi, and metasomal venter yellowish, those of undersides of tarsi orange; prepygidial and pygidial fimbriae brown or blackish dorsally, white only laterally. Punctuation. Labrum impunctate and shining (dull in worn individuals) from transverse ridge to base, closely punctate distally. Lower two thirds of clypeus with coarse punctures (absent on median ridge) separated by about a puncture width of shining ground (dull in worn individuals); upper and lateral parts of clypeus with somewhat finer and closer punctures; supraclypeal and lower paraocular areas with fine, close punctures, less close higher on face and on genal area, on vertex lateral to ocelli smooth with only scattered, coarser punctures; scutum and scutellum with moderately coarse punctures (about size of those of upper part of clypeus), separated by about a puncture width of shiny ground on scutum except margins, closer on scutellum and margins of scutum; mesepisternum more coarsely and closely punctate; rest of side of thorax and lower part of propodeum with much finer punctures; propodeal triangle polished and shining but minutely, irregularly roughened. Metasomal terga I-IV finely punctate, shining, with coarser punctures laterally and just anterior to bases of fasciae, fine and close at fascial bases, posterior marginal zones smooth, shining, impunctate; tergum V coarsely punctate except finely so in area that supports prepygidial fimbria. Male: Length 9 mm; forewing length 6 mm. Agrees with description of female except as follows: Structure. Clypeus and supraclypeal area without longitudinal median ridge; minimum distance between eyes less than length of eye; genal area wider than eye seen from side; distance between posterior ocelli equal to ocellocular distance; ocelloccipital distance about twice ocellar diameter; flagellar segment 1 short and robust but because of short scape, about one third as long as scape; flagellar segments all longer than broad, 1 and 2 only slightly so, 1-4 convex on upper side so that base of flagellum is crenulate, segments 1-9 of uniform thickness but 10-11 slightly thicker. Mid and hind leg modifications as noted in description of subgenus. Coloration. Distal part of mandible red, apical parts of femora red. Flagellar segments 3-9 light red, upper surfaces of 3 and 4 infuscated; segments 1-2 partly light red, segments 10-11 black; metasomal terga I-VI with transparent, depressed margins. Wings nearly clear. Pubescence. Long white hair obscuring surface of entire face; white metasomal fasciae on terga I-VI, not weak or broken medially. Punctuation. Clypeus finely and closely punctate. Terga V and VI punctured about like more anterior ones.

Type material. Holotype female and 1 female paratype: Namibia (= South West Africa): 61 km west of Omaruru, March 21, 1979 (J. G. Rozen). Allotype male and 2 female paratypes, same data but March 22, 1979; 1 male paratype, same data but March 15, 1979. Three female paratypes: 32 km west of Omaruru, March 15, 1979, on Indigofera (J. G. and B. L. Rozen). The holotype and allotype are in the American Museum of Natural History; paratypes are in that institution except for two in the Snow Entomological Museum, University of Kansas.

Etymology. The specific name refers to the banded (fasciate) condition of the metasoma.

LITERATURE CITED

- Alfken, J. D. 1936. Schwedisch-chinesische wissenschaftliche Expedition nach den nordwestlichen Provinzen Chinas.... Insekten, Hymenoptera, Apidae. Ark. Zool., 27A:1-24.
- Ashmead, W. H. 1899. Classification of the bees, of the superfamily Apoidea. Trans. Amer. Ent. Soc., 26:49-100.
- Baker, D. B. 1965. Two bees new to Britain. Ent. Monthly Mag., 100:279-286.
- Benson, R. B., C. Ferrière, and O. W. Richards. 1947. Proposed suspension of the Règles for Macropis (Klug MS.) Panzer, [1806-1809], and Megilla Fabricius, [1804-1805]. Bull. Zool. Nomen., 1:210.
- Blanchard, E. 1840. Histoire Naturelle des Insectes. vol. 3, Paris.
- Cockerell, T. D. A. 1898. New bees from New Mexico. Canadian Ent., 30:146-148.
- _____. 1909. Descriptions and records of bees--XXIII. Ann. Mag. Nat. Hist., (8)4:393-404.
- _____. 1910. New and little-known bees. Trans. Amer. Ent. Soc., 36:199-249.
- _____. 1915. Descriptions and records of bees--LXVI. Ann. Mag. Nat. Hist., (8)15:341-350.
- _____. 1931a. Descriptions and records of bees--CXXV. Ann. Mag. Nat. Hist., (10)7:201-212.
- _____. 1931b. Some African bees. Ann. Mag. Nat. Hist., (10)8:400-405.
- _____. 1932. Descriptions and records of bees--CXXXV. Ann. Mag. Nat. Hist., (10)10:166-176.
- _____. 1933a. Descriptions and records of bees--CXLII. Ann. Mag. Nat. Hist., (10)11:372-384.
- _____. 1933b. Descriptions and records of bees--CXLV. Ann. Mag. Nat. Hist., (10)12:126-136.
- _____. 1934. Descriptions and records of bees--CXLVIII. Ann. Mag. Nat. Hist., (10)13:444-456.
- _____. 1935. Scientific results of the Vernay-Lang Kalahari expedition, March to September, 1930--Hymenoptera (Apoidea). Ann. Transvaal Mus., 17:63-94.
- _____. 1936. Descriptions and records of bees--CLII. Ann. Mag. Nat. Hist., (10)17:24-31.
- _____. 1937. Bees collected in Arizona and California in the spring of 1937. Amer. Mus. Novitates, no. 948:1-15.
- _____. 1941. Observations on the plants and insects in north-western Baja California, Mexico, with descriptions of new bees. Trans. San Diego Soc. Nat. Hist., 9:337-352.
- Cockerell, T. D. A. and L. M. Ireland. 1933. The relationships of Scrapper, a genus of African bees. Proc. Nat. Acad. Sci. (U.S.A.), 19:972-978.
- Curtis, J. 1831. British Entomology. vol. 8, pls. 338-383, London.
- Dalla Torre, C. G. de. 1896. Catalogus Hymenopterorum. Vol. X, Apidae. viii + 643 pp., Leipzig.
- Fabricius, J. C. 1804. Systema piezatorum. iii-xiv + 15-349 + 1-30 pp., Braunsvig.
- Farris, J. S. 1970. Methods for computing Wagner trees. Syst. Zool., 19:83-92.

- Friese, H. 1908. Neue Bienenarten aus Ostafrika. Deutsch. Ent. Zeitschr., 1908:567-572.
- _____. 1909. Die Bienen Afrikas nach dem Stande unserer heutigen Kenntnisse, In L. Schultz, Zoologische und Anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Südafrika ausgeführt in den Jahren 1903-1905, Band 2, Liefg 1. X Insecta (ser. 3), (Jenaische Denkschriften vol. 14), pp. 83-476, pls. ix-x.
- _____. 1911. Neue Bienen der äthiopischen Region. Zool. Jahrb. (Syst.), 30:671-678.
- _____. 1912. Neue und wenig bekannte Bienen Süd-Afrikas. Arch. Naturg., 78(Abt A, Heft 5):181-189.
- _____. 1930. Neue Arten der Bienengattung Nomia aus Afrika. Konowia, 9:13-33.
- Hedicke, H. 1931. Beiträge zur Synonomie der Apiden (Hym.) I. Mitt. Deut. Ent. Gesell., 2:34-38.
- Jander, R. 1976. Grooming and pollen manipulation in bees (Apoidea): the nature and evolution of movements involving the foreleg. Physiological Ent., 1:179-194.
- Kirby, W. 1802. Monographia apum angliae. vol. 1, xxii + 258 pp., Ipswich.
- Latreille, P. A. 1802. Histoire Naturelle de Fourmis 445 pp., 12 pls., Paris.
- Leach, W. E. 1815. Entomology in Brewster's Edinburgh Encyclopedia, vol. 9, pp. 57-172, Edinburgh.
- Lepelletier de Saint-Fargeau, A. 1841. Histoire naturelle des insectes-Hyménoptères vol. 2, 680 pp., Paris.
- Lind, H. 1968. Nest provisioning cycle and daily routine of behavior in Dasypoda plumipes. Entom. Meddelelser, 36:343-372.
- Malyshev, S. I. 1923. The nesting habits of Melitta leporina Pz. Bull. Inst. Lesshaft, 6:1-7 [In Russian].
- _____. 1927. The nesting habits of Dasypoda. Trav. Soc. Natural. Leningrad, 57:123-146 [In Russian].
- _____. 1929. The nesting habits of Macropis. Eos, 5:97-109, pls. II, III.
- McGinley, R. J. 1980. Glossal morphology of the Colletidae and recognition of the Stenotritidae at the family level. Jour. Kansas Ent. Soc., 53:539-552.
- Meade-Waldo, G. 1916. Notes on the Apidae (Hymenoptera) in the collection of the British Museum, with descriptions of new species. Ann. Mag. Nat. Hist., (8)17:448-470.
- Michener, C. D. 1938. A review of the American bees of the genus Macropis. Psyche, 45:133-135.
- _____. 1944. Comparative external morphology, phylogeny, and a classification of the bees. Bull. Amer. Mus. Nat. Hist., 82:151-326.
- _____. 1965. A classification of the bees of the Australian and South Pacific regions. Bull. Amer. Mus. Nat. Hist., 130:1-361, pls. 1-15.
- _____. Submitted. Proposal to suppress first designation of a type species for the generic name Megilla Fabricius, 1805, and to place Macropis Klug, 1809, on the Official List of Generic Names. Bull. Zool. Nomen.

- Michener, C. D. and A. Fraser. 1978. A comparative anatomical study of mandibular structure in bees. Univ. Kansas Sci. Bull., 51:463-482.
- Michener, C. D. and L. Greenberg. 1980. Ctenoplectridae and the origin of long-tongued bees. Zool. Jour. Linnean Soc. [London], 69:183-203.
- Mitchell, T. B. 1960. Bees of the eastern United States, vol. 1, North Carolina Agr. Expt. Sta. Tech. Bull., no. 141:1-538.
- Panzer, G. W. F. 1809. Faunae insectorum Germaniae initiae. Heft 107, no. 16, Nurnberg.
- Popov, V. B. 1936. A new bee of the genus Ctenoplectra Sm. Proc. Royal Ent. Soc. London, (B)5:78-80.
- _____. 1940. A new genus of bees from Turkestan. Trudy Zool. Inst. Akad. Nauk U.S.S.R., 6:53-60 [In Russian].
- _____. 1949. The tribe Pararhophitini as an early Tertiary element of the contemporary fauna of the desert in central Asia and Egypt. Doklady Akad. Nauk U.S.S.R., 66:507-510 [In Russian].
- _____. 1955. Zoogeographic attributes of the genus Eremaphanta. Doklady Akad. Nauk U.S.S.R., 101:569-572 [In Russian].
- _____. 1957. New species and peculiarities of geographical distribution of the bees of the genus Eremaphanta Popov. Zool. Zhurn., 36:1704-1716 [In Russian].
- _____. 1958. Peculiar features of correlated evolution of two genera of bees--Macropis and Epeoloides (Hymenoptera, Apoidea) and a plant genus Lysimachia (Primulaceae). Rev. Ent. U.R.S.S., 37:499-519 [In Russian].
- Popov, V. B. and D. Guiglia. 1936. Note sopra i gen. Ctenoplectra Sm. e Macropis Panz. Ann. Mus. Civ. Storia Nat. Genova, 59:275-288.
- Quilis, M. 1928. Estudio monographico de las Dasypoda Latr. Eos, 4:173-241, pls. III-V.
- Radoszkowski, O. 1891. Révision des armures copulatrices des males des genres Cilissa et Pseudocilissa. Horae Soc. Ent. Rossicae, 25:236-243.
- Rafinesque, C. S. 1815. Analyse de la nature. 224 pp., Palermo.
- Richards, O. W. 1935. Notes on the nomenclature of the aculeate Hymenoptera, with special reference to the British genera and species. Trans. Royal Ent. Soc. London, 83:143-176.
- Rozen, J. G., Jr. 1974. The biology of two African melittid bees. Jour. New York Ent. Soc., 82:6-13.
- _____. 1977. Biology and immature stages of the bee genus Meganomia. Amer. Mus. Novitates, no. 2630:1-14.
- _____. 1978. The relationships of the bee subfamily Ctenoplectrinae as revealed by its biology and mature larva. Jour. Kansas Ent. Soc., 51:637-652.
- Rozen, J. G., Jr. and N. R. Jacobson. 1980. Biology and immature stages of Macropis nuda, including comparisons to related bees. Amer. Mus. Novitates, no. 2702:1-12.
- Rozen, J. G., Jr. and R. J. McGinley. 1974. Phylogeny and systematics of Melittidae based on mature larvae. Amer. Mus. Novitates, no. 2545:1-31.
- Sakagami, S. F. 1976. Melitta japonica Hirashima with two submarginal cells. Kontyu, 44:333.
- Sandhouse, G. A. 1943. The type species of the genera and subgenera of bees. Proc. U. S. Nat. Mus., 92:519-619.

- Saunders, E. 1882. Synopsis of British Hymenoptera. Diploptera and Anthophila; Part I to end of Andrenidae. Trans. Ent. Soc. London, pp. 165-290, pls. VII-XI.
- Stage, G. I. 1966. Biology and systematics of the American species of the genus Hesperapis Cockerell. [iii] + 1-461 pp., unpublished Ph.D. thesis, Univ. of California, Berkeley.
- . 1971. Family placement of the African genus Meganomia Cockerell with a review of included species. Proc. Ent. Soc. Washington, 73:306-313.
- Stevens, P. F. 1980. Evolutionary polarity of character states. Ann. Rev. Ecol. Syst., in press.
- Strand, E. 1920. Notes sur quelques Apides du Congo Belge. Revue Zoologique Africaine, 8:87-106.
- Tirgari, S. 1968. Le choix du site de nidification par Melitta leporina (Panz.) et Melitturga clavicornis (Latr.). Ann. Abeille, 11:79-103.
- Viereck, H. L. 1909. Descriptions of new Hymenoptera. Proc. Ent. Soc. Washington, 11:42-51.
- Vogel, S. 1976. Lysimachia: Olblumen der Holarktis. Naturwissenschaften, 63:44.
- Warncke, K. 1973. Die westpalaarktischen Arten der Bienenfamilie Melittidae. Polskie Pismo Entom., 43:97-126.
- . 1977. Ideen zum natürlichen System der Bienen. Mitt. Münch. Ent. Ges., 67:39-63.
- Westwood, J. O. 1840. An introduction to the modern classification of insects Vol. 2, Synopsis of the genera of British Insects, 587 pp., London.
- Winston, M. L. 1979. The proboscis of long-tongued bees: a comparative study. Univ. Kansas Sci. Bull., 51:631-667.
- Wu, Y.-J. 1978. A study of Chinese Melittidae with descriptions of new species. Acta Ent. Sinica, 21:419-428.
- Yasumatsu, K. and Y. Hirashima. 1956. Discoveries of the genus Macropis Klug and Melitta Kirby in Japan. Kontyu, 24:247-255, pl. 26.